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Valuing the North Sea: assessing the public benefits of marine protection and sustainable management of the North Sea

Part I: Contingent valuation face-to-face interviews

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Abstract

The main objective of this study is to assess the public benefits associated with the protection and sustainable management of the North Sea. For this purpose, 600 face-to-face beach interviews were carried out with a non-representative sample of beach visitors in August 2006 at 10 different beaches along the Dutch North Sea coast and on the island of Texel, using a structured questionnaire design. Besides a baseline scenario, respondents were presented with two possible future development scenarios for the protection and sustainable management of the North Sea: one where ecologically valuable and vulnerable areas are designated as protected marine parks with limited economic activity and one where the same areas are fully protected and no economic activities are allowed at all.

Half of the interviewed beach visitors believe that the seawater is currently clean. Ten percent says it is polluted, while a quarter does not know. Some small differences are found between interview locations in the three coastal provinces and on the island of Texel. Forty percent of the beach visitors have no idea how seawater quality has changed (or not) over the past 10 years. One third believes that the seawater quality has improved, while 20 percent thinks it has not changed and 10 percent thinks it has deteriorated. Nevertheless, a majority of 80 percent of all beach visitors believes that the protection of the natural areas in the North Sea is equally as important as the protection of natural areas on land. Ten percent thinks that the protection of the North Sea is even more important, while another 10 percent says this is less important. Most beach visitors prefer a protected status with limited use. Just over a quarter prefers a fully protected status for the designated valuable and vulnerable natural areas. Only 5 percent prefers continuation of the current situation.

A majority of 72 percent of those beach visitors who prefer some level of protection of the North Sea in the future is also willing to pay for this in principle. The most important reasons why beach visitors are willing to pay is their concern for the environment in general and future generations. Average willingness to pay per household per year varies between 43 euros for protected areas with limited use and 53 euros for fully protected areas. Assuming, for example, that half of all Dutch households benefit as beach visitors from the protection and sustainable management of the North Sea, a total annual economic value is found of about 150 million euros. Discounted for example over a 10-year time period at a conventional discount rate of 4 percent, a total present value is found of 1.2 billion euros.

1. Introduction

The European Marine Strategy (EMS) is one of the thematic strategies in the sixth European Environmental Action Plan, aiming to achieve a sustainable balance between the use and protection of all European marine areas. In this context, the Dutch Government has committed itself to carry out an impact assessment in order to assess the social costs and benefits associated with the implementation of the EMS. A preliminary assessment of the costs of additional EMS measures to protect the North Sea shows that these costs are limited, ranging between 15 and 135 million euros annually. Possible types of measures include the reduction of chemical contaminants, which cause *inter alia* eutrophication of seas, the protection of ecologically vulnerable zones, sustainable management of fish stocks and the reduced risk of ecosystem disasters (e.g. oil spills). This implies an increase of the current annual costs between one and eight percent. Current policy is mainly aimed at the reduction of the inflow of chemical and nutrient pollution into the North Sea through the main rivers. Like the Water Framework Directive (2000/60/EC), the draft version of a European Framework Directive for the Protection of the Marine Environment does not include concrete environmental objectives. It merely states that it aims to reach a good environmental status.

The main objective of this report is to provide a first preliminary assessment of the public benefits associated with the implementation of a Marine Water Framework Directive (MWFD) and the achievement of good environmental status in the North Sea. This benefits assessment can be used in a pre-feasibility assessment of the costs and benefits of implementation of the MWFD in the Netherlands. Besides more sustainable use values, it is also, or perhaps even more so (future) option values and non-use values, which are expected to make up a large share of the public benefits associated with reaching good environmental status in the North Sea.

In order to assess the public benefits of a more sustainable balance between the use and protection of the North Sea, a small-scale contingent valuation study is carried out along the North Sea coast, the results of which are reported in this report. Six hundred Dutch beach visitors are interviewed during the summer on several beaches along the North Sea coast and the island of Texel and asked a series of questions about their interest in the North Sea and its future protection.

Contingent valuation (CV) is the only method available, which is able to assess both the use and non-use values associated with reaching good environmental status in the North Sea. CV is a survey-based approach, which is able to elicit useful, policy relevant information about public perception, attitudes and opinions about environmental policy such as the new MWFD and expected changes in the natural environment. In this sense, the CV method is very similar to a public poll. However, besides information about public opinion of the urgency and priority to be given to the protection of the North Sea, the CV method also allows for the assessment of public willingness to pay (WTP) for the proposed policy. Taxpayers are asked how they feel about proposed policy measures and whether they feel the proposed policy is worthwhile funding. In this way, the method provides useful information to policy and decision-makers by informing them whether the public at large (as tax payers) believes that the implementation costs of the new pol-

icy are worth taking and/or good value for money given the expected and perceived benefits associated with the protection of the North Sea. This information can help policy and decision-makers decide whether the implementation of a MWFD is worth further pursuing or not. A similar study was carried out in 2003 for the implementation of the European Water Framework Directive¹. For a more detailed discussion about the use and usefulness of the method in water policy and management, the interested Dutch reader is referred to Brouwer (2006)².

The remainder of this report is organized as follows. Chapter 2 introduces the current state of and pressures on the North Sea. The content of the European Marine Strategy is described in more detail and how this information is converted into different valuation scenarios for the CV survey. Chapter 3 presents the research methodology, addressing the sampling procedure, the questionnaire design and the methodological tests performed to evaluate the validity and reliability of the survey results. The survey results are then presented in chapter 4, including the demographic and socio-economic characteristics of the survey sample population, their perception and attitude towards the current state of the North Sea and the perceived benefits of a more sustainable management and protection of the North Sea. Finally, chapter 5 concludes and provides recommendations for future policy.

¹ See Brouwer, R. (2004). Wat is schoon water de Nederlander waard? *H₂O*, nr.12, pag. 4-5.

² Brouwer, R. (2006). De betrouwbaarheid en bruikbaarheid van de CV methode in het Nederlandse waterbeleid. *Tijdschrift voor Politieke Economie*, 27(3), 52-65.

2. The North Sea

2.1 Current state and pressures

The North Sea is one of the world's major shelf areas and one of the major fish producing ecosystems in the world. It is a relatively shallow semi-enclosed basin of continental shelf water with a depth ranging from about 30 m on average in the southeast to 200 m in the northwest. Eight countries border the North Sea (France, Germany, Belgium, The Netherlands, Norway, Sweden, United Kingdom, Denmark). The Exclusive Economic Zone of the Netherlands (or NCP Nederlands Continentaal Plat) has a surface area of **xx** km², or 1.5 times the land area.

Anthropogenic impacts have been significant for many years. The marine ecosystems are under intense pressure from fishing, nitrogen input (from air and rivers), recreational use and habitat loss. The seabed is rich in oil and gas and sand extraction provides valuable material for the building industry. All these resources are intensively exploited: see Figure 1. New developments and pressure on the North Sea ecosystem are the planning of off shore wind farms and aquaculture.

Over the last decade, there has been an increasing awareness and concern for the impaired status of several of the North Sea's commercially important fish stocks, as well as the impact of fisheries on other parts of the ecosystem.

2.2 European Marine Strategy

One promising approach to reduce the impact of fishing on marine ecosystems is the idea of establishing networks of Marine Protected Areas (MPAs) at local, regional and global levels. In European waters the main way this is being achieved is through two types of protected areas: Special Protected Areas (SPAs) for birds which are put in place through the Birds Directive (79/409/EEC); and Special Areas of Conservation for habitats and species, which are put in place through the Habitats Directive (92/43/EEC).

In 2002, at the Fifth International Conference on the Protection of the North Sea (Bergen), the ministers agreed to implement an ecosystem approach by identifying and taking action on influences, which are critical to the health of the North Sea ecosystem (OSPAR, 2006). To reach this goal, the implementation of ecosystem-based marine management, built on scientific knowledge, is essential. The Commission has completed the groundwork for this by putting forward its Thematic Strategy for the Marine Environment (COM 2005).

This European Marine Strategy (EMS) is a very important tool to provide protection of vulnerable marine areas below sea level. Biologically productive areas in the shallow parts of the North Sea require the integral protection of both benthic and pelagic communities and seabirds. The Marine Strategy Directive provides a framework for adoption of a wide range of necessary measures for the protection of marine biodiversity in the North Sea (Lindeboom & Bäck, 2005), something that is out of scope of the OSPAR convention (Dotinga, 2001).

2.3 Marine Protected Areas

'Nature reserves', 'sanctuaries', 'refuges' and 'parks' are familiar terms that have been used to describe protected areas. In this report they will be referred to as Marine Protected Areas (MPAs), a term used here in a general sense to refer to any specified area in which there is partial or total protection from fishing and other potentially damaging impacts (e.g. dredging, drilling).

The Netherlands has taken up spatial planning at sea in the policy document on spatial planning. This has been more specified in the Integrated Management plan of the North Sea 2015 (IDON, 2005). Attention is given to the Netherlands EEZ on space for Sensitive sea areas (in advance of the establishment of MPA's / areas under the Bird and Habitat directive) wind energy, land reclamation, sand extraction, military activities, cables, pipes and platforms and shipping lanes, and fishery.

Note that the EMS does not override or obviate obligations under the Habitats and Birds Directives in SPA's. The EMS will foster longer-term support for the protection and restoration of these habitats and species, in particular by improving the wider environmental condition of the marine environment (MPAs) The IBN 2015 has identified the following areas of the Dutch EEZ as future SPAs and MPAs: See Figures 3 and 4.

Coastal Sea

The coastal sea has a high biodiversity of fauna and is of large importance for birds, fish and mammals. The Southern (Voordelta) and Northern (Hollandse kust) parts are already indicated as area under the Bird- and Habitat directive. It is proposed to extend the marine protection area to the -20 m line. The Southern coastal sea will include the Vlake van Raan in the Scheldt estuary mouth. Note that the marine area in the north is connected to the Wadden tidal flats.

The Frisian Front

The Frisian Front is a unique region characterized by high biomass and large diversity in benthic fauna. Specific birds and fish (Thornback ray) can be found here in great abundance at specific times of the year. In the autumn more than 1% of the population of the Great skua's in North-west Europe forages in this area. In the summer more than 20000 Guillemot are found in this area. Therefore the Friesian Front complies with the Bird directive.

Cleaverbank

The Cleaverbank has an exceptional benthic sediment structure of gravel combined with very specific flora and fauna. The area is also valuable for its birdlife. The area complies with the Habitat directive. The intersecting gulley (Botney Cut) is included in the area. Although the UK EEZ has similar areas, it is not certain that UK will nominate adjoining areas.

Doggersbank

De Doggersbank is well known for its high biodiversity of benthic fauna, but it has also nature value based on the importance for birdlife and fish. Especially the slopes between -30 and -40 m depth are valuable. The indicated borders of the Doggersbank MPA will match the German area that is nominated for the Habitat directive.

A major part of the NCP coast sea, i.e. with depth less than 20 meters (-20 m line), is already nominated as Special Protected Area (SPAs) for birds (Birds Directive) and/or Special Areas of Conservation for habitats (Habitats Directive). These areas are found along the Zeeland coast (Voordelta) and the Northern part of the Holland, including the islands of the Wadden tidal flats. It is proposed in the IBN 2015 report to extent the protection to the marine part of the ecosystem.

From the large range of different ecosystems in the North Sea an assessment has been made to identify all unique ecosystem aspects that are worthwhile to conserve (see Lindeboom et al., 2005). The assessment includes biotic parameters (benthic, pelagic and birdlife inventory) that are related to the Birds directive, Habitat directive and OSPAR directives. Also the sediment is characterized and tested on compliance with the habitat directive. An assessment of the immediate threats by the current and future economic use of the North Sea included fishery, shipping, military activities, recreation, wind energy, oil and gas, cables, sand extraction, dredging and dumping of dredge material, large infrastructures (Maasvlakte 2, Airports at Sea).

Based on this assessment the IBN 2015 has nominated next to the coastal sea the Doggersbank, Friese Front and Klaverbank as future MPAs. These four areas cover 15% of the NCP area, 85 times the surface of the Veluwe, the largest man-made park in the Netherlands.

3. Research methodology

3.1 Economic valuation of the environment

In environmental economics, various models and techniques have been developed to measure the value people attach to unpriced natural resources and the services these resources provide. Environmental values are measured in money terms through the concept of individuals' willingness to pay (WTP) or willingness to accept (WTA) compensation in order to make them commensurable with other market based values. Of these two, the WTP approach has become the most frequently applied and has been given peer review endorsement through a variety of studies (*e.g.* Cummings *et al.*, 1986; Arrow *et al.*, 1993). One important reason for this endorsement is that WTP is theoretically constrained by income levels whereas WTA is not. The WTP measure is therefore believed to produce more reliable valuation outcomes.

Aggregated across those who benefit from natural resources and their services and who will hence be affected by any change in their provision level, including quality level, the aggregated WTP or WTA amount provides an indicator of their total economic value (TEV). An aggregate measure of the impact on social welfare does not consider inequalities in the distribution of gains and losses among individuals. Willingness to pay relates essentially to individuals' ability to pay, which determines the relative weights assigned to their preferences. Its use infers acceptance of the prevailing distribution of income.

Environmental economists have introduced a taxonomy of this TEV, distinguishing between use values and non-use values, in order to account for the various reasons and motives people may have to value environmental change. Use values are associated with the actual or potential future use of a natural resource (*e.g.* drinking water, fish consumption, irrigation water). Non-use values are not related to any actual or potential future use, but refer to values attached to the environment and natural resource conservation based on considerations that, for example, the environment should be preserved for future generations or because plants and animals also have rights.

Together with other market based values, the estimated TEV of environmental change can be included in an 'extended' cost-benefit analysis (CBA), including environmental effects. If total benefits exceed total costs, the policy or project evaluated will result in an improvement of total economic welfare, as losses can, hypothetically, be fully compensated by the gains. This is the so-called Kaldor-Hicks compensation principle, also known as the neo-Paretian welfare criterion. Standard handbooks on CBA and extended CBA are, for example, Dasgupta and Pearce (1972); Mishan (1976); Hanley and Spash (1993); Layard and Glaister (1994).

The monetary WTP and WTA measures indicate how changes in the provision level of public environmental goods, including quality changes, impact upon individual utility or welfare. The notion of individual utility is at the core of neo-classical economic theory, from which the values above are derived. In this theory, values are determined by what individuals want (individual preferences) and measured by the extent to which they are willing to trade-off scarce means such as time or money income to obtain something (secure a gain), preserve something (prevent a loss) or accept in compensation when losing

something (either forego a gain or tolerate a loss). A change in welfare is evaluated as the money income adjustment (WTP or WTA) necessary to maintain a constant level of welfare before and after these changes (Hicks, 1939).

A distinction can be made between two types of welfare measures based on two different points of reference (Hicks, 1943): the 'compensating surplus' (CS) and the 'equivalent surplus' (ES). The former equals the money income adjustment necessary to keep an individual at his initial welfare level before the change in the provision level of a public environmental good, while the latter equals the money income adjustment necessary to maintain an individual at his new welfare level after the change in the provision level of the environmental good. Bateman and Turner (1993) distinguish between four relevant welfare measures associated with welfare gains and welfare losses:

- WTP to secure a welfare gain (CS_{WTP});
- WTA to forego a welfare gain (ES_{WTA});
- WTP to prevent a welfare loss (ES_{WTP});
- WTA to tolerate a welfare loss (CS_{WTA}).

The choice for one of these measures depends *inter alia* on the perceived distribution of property rights to the environmental good or service involved (e.g. Freeman, 1979; Knetsch and Sinden, 1984; Hanemann, 1991).

WTP can be measured in practice either directly by asking people to state a WTP amount in a CV social survey format, or indirectly by assuming that this value is reflected in the costs incurred to travel to specific sites (travel costs (TC) studies) or prices paid to live in specific neighbourhoods (hedonic pricing (HP) studies). The latter two approaches measure environmental use values through revealed preferences, while CV is believed to be able to also measure non-use or passive use values through stated preferences. Of these three methods, CV is probably the most widely applied method in contemporary valuation research (Carson *et al.*, 1995; Bateman and Willis, 1999).

In a CV survey, individual respondents are presented with information about a hypothetical environmental change. If carefully administered after thorough pre-testing, the CV survey should be able, in principle, to elicit respondent perception, viewpoints, attitude and hypothetical behaviour towards this change. Valuations are most typically elicited by asking respondents for their WTP to secure the change and hence the associated benefits. In this way, the method circumvents the absence of a market for the environmental goods or services involved by presenting a hypothetical market in which respondents have the opportunity to buy them (Mitchell and Carson, 1989). The hypothetical market construct evokes a number of well researched and documented systematic distortions between expressed and 'true' WTP. Detailed overviews of these distortions, which are generally classified according to whether they are specific to the method (instrument) or the sampling procedure used, are found, for example, in Mitchell and Carson (1989) or Bateman and Turner (1993). Some of the instrumental distortions may reflect more general phenomena in communication consistent with findings in socio-psychological research of decision-making (Schkade and Payne, 1994).

The use of the word ‘true’ economic value may give rise to misunderstanding or misinterpretation. True is defined here as a WTP value free of systematic distortions. Even when researchers are able to eliminate or control for all potential distortions in CV surveys, WTP values still are, like any other economic value, relative and contextual (Randall, 1988).

The issue of what constitutes a distortion-free (valid) and satisfactory CV design has received a lot of attention in the CV literature. Starting with the state-of-the-art report by Cummings *et al.* (1986), it has been argued that the use of the CV method should be restricted to situations which best emulate consumer markets. Subjects should understand and be familiar with the commodity to be valued and they should have had (or be allowed to obtain) prior valuation and choice experience with respect to consumption levels of that commodity. Meeting these conditions clearly limits the use of the CV method to those environmental goods and services, which are currently already being marketed, like emission or hunting permits (Mitchell and Carson, 1989). Alternatively, political markets such as referenda have been suggested as a more appropriate analogue for CV surveys that value public goods in a private market setting (*e.g.* Harris *et al.*, 1988; Mitchell and Carson, 1989).

Fischhoff and Furby (1988) argue that a ‘satisfactory transaction’, that is, one in the traditional neo-classical sense in which people are fully informed, uncoerced and able to identify their own best interests, can only take place if:

- the environmental good;
- the method of payment;
- the constructed market

are well defined and well understood by the individual.

Similarly, based on the theoretical background of CV, Mitchell and Carson (1989) argue that CV scenarios must define and communicate to respondents:

- the reference level of utility, *i.e.* awareness of current disposable income and description of the property rights situation;
- the nature of the public good;
- the relevant prices of other goods;
- conditions for provision of the good and payments for it;
- the nature of the WTP amount desired, *i.e.* the value of the good in question.

Regarding this last point, the ‘purchase of moral satisfaction’ (Kahneman and Knetsch, 1992) or ‘stating a fair price’ would undermine the validity and reliability of CV results.

In their ‘best practice’ recommendations, the NOAA Panel (Arrow *et al.*, 1993) provides an extensive list of guidelines for CV survey construction, administration and analysis. These guidelines for value elicitation in order to assure reliability and usefulness of the obtained information include:

- a conservative survey design;
- the use of the willingness to pay format;

- the use of the referendum format;
- the provision of adequate and accurate information about the environmental program that is being offered;
- a reminder of substitute commodities.

The Panel furthermore distinguishes a subset of items which it calls the ‘burden of proof’ requirements. The Panel judges CV findings unreliable if it suffers from:

- a high non-response rate, either to the entire survey instrument or the valuation question;
- inadequate responsiveness to the scope of the environmental insult, *i.e.* stated choices should reveal a smaller WTP for smaller amounts of an environmental commodity provided by an environmental program;
- lack of understanding of the task by respondents;
- lack of belief in the full restoration scenario;
- ‘yes’ or ‘no’ votes on the hypothetical referendum that are not followed up or explained by making reference to the cost and/or the value of the program.

From the recommendations above, the description of the environmental good, respondent familiarity with the good, or at least clear understanding of the good, and the contextual setting of the problem seem to emerge as common elements considered essential to CV. The former includes the proper description of the relevant attributes and their reference and target levels (Fischhoff and Furby, 1988), while the latter includes the social context of the survey (Schkade and Payne, 1994).

3.2 Sampling and survey procedure

A total of six hundred face-to-face interviews were carried out by 12 trained interviewers at pre-selected beaches in the three Dutch provinces along the North Sea coast: Zeeland, South-Holland and North-Holland. The interview period lasted 3 weeks from Monday 14 August until and including Saturday 2 September 2006. On average, each interviewer carried out approximately 50 face-to-face interviews.

In each province three or four beaches were selected for the interviews (see Figure 3.1). These beaches were selected from a complete list of beaches in the Netherlands on www.hollandbeach.nl using geographical spread and beach size as the two most important selection criteria. Twenty-two percent of the interviews took place in Zeeland, 28 percent in South-Holland, another 22 percent in North-Holland and 28 percent on the island of Texel. In the latter case, part of the interviewing also took place on the ferry from Den Helder to Texel.

Beach visitors were approached at random on a ‘next to pass’ basis. Interviewers were instructed to interview an equal amount of men and women from a wide spread of ages from 18 years and over. After agreeing to participate, beach visitors were informed about the main objective of the survey, that the survey is part of an independent research project carried out by the Vrije Universiteit and that the interview aims to elicit beach visitor’s opinions and perceptions only.

Figure 3.1: Situation of the interview locations along the North Coast (number of face-to-face interviews between brackets)



3.3 Questionnaire design

The questionnaire was developed during an extensive pretest procedure over a period of 4 weeks, where draft versions of the questionnaire were tried and tested in two different pretests based on 70 face-to-face beach interviews in Zandvoort and Bloemendaal. The valuation scenarios were developed by two IVM marine scientists with the help of the available information about the European Marine Strategy. Draft versions of the questionnaire were furthermore screened by representatives of the Society for the North Sea ('Stichting Noordzee') and the Dutch National European Marine Strategy Working Group.

The final version of the questionnaire consists of five main parts. The first part focuses on beach visitors' travelling behaviour (from home or holiday resort to beach) as the basis for the estimation of a travel cost model. This part contains detailed questions about travel routes, travel modes, travel distances, travel times and travel costs. Respondents are furthermore asked about beach visiting frequencies, their appreciation of the beach

where they are interviewed, the activities they undertake when visiting the beach, whether they visit other beaches in the Netherlands and if so, how often.

The second part of the questionnaire consists of a series of questions related to respondent perception of the current state of the North Sea, the quality of bathing water and eatable fish, concerns related to the current state of the North Sea and pressures on the North Sea. Respondents are also asked to rank a number of possible risks associated with the North Sea, including bathing water quality, oil spills, health risks associated to eating North Sea fish and inundations as a result of climate change and sea level rise.

Respondents are then informed about the actual state of the North Sea, existing and possible future threats and the development of new policy towards a more sustainable management of the North Sea, including the designation and protection of vulnerable natural parks on the North Sea. The cards used during the interview and the explanatory text going with the cards are reproduced in the annex of this report. Respondents are asked how familiar they are with the presented information and how much they believe of everything they have been told. After that, they are presented with three possible future policy and management scenarios for the North Sea:

- 1) Continuation of the current situation where nothing changes, the North Sea or parts thereof do not get a protected status and economic activities in ecologically vulnerable zones are not restricted.
- 2) Situation where certain ecologically valuable and vulnerable areas become designated protected zones above and below sealevel, where economic activities such as fishery, shipping, sand extraction and gas drilling are allowed albeit conditional to certain restrictions and under strict control.
- 3) Situation where certain designated ecologically valuable and vulnerable areas become fully protected zones above and below sealevel where current economic activities such as fishery, shipping, sand extraction or drilling are banned.

In this third part of the questionnaire respondents are asked how important they consider protection of the North Sea compared to the protection of ecologically valuable and vulnerable areas on land such as the National Park Veluwe or Biesbosch. They are also asked for their most preferred future situation. They are then informed furthermore about the fact that sustainable management of the North Sea and the protection of ecologically valuable and vulnerable zones requires taking a number of measures and hence comes at a cost (see the annex). Following this information statement, respondents are asked a series of questions related to their WTP for sustainable management of the North Sea and the protection of ecologically sensitive areas. The economic welfare measure estimated here is beach users' compensating surplus.

First respondents are asked whether they are willing to contribute financially to the protection of the North Sea in principle without providing any institutional-economic context (e.g. payment mode and frequency). Secondly, they are asked a more detailed 'double bounded' binary WTP question. This means that respondents are asked whether they are willing to pay a specific start bid (money amount) ranging between 5 and 250 euros per household per year in terms of extra income taxation, and depending on their reply (yes or no), they are asked for their WTP for a follow-up bid. This procedure yields an

interval WTP value for each individual respondent. The applied bid tree used is presented below.

Start bid	Reply	Follow-up bid
€5	N	€3
	Y	€10
€10	N	€5
	Y	€15
€25	N	€15
	Y	€35
€50	N	€25
	Y	€75
€75	N	€50
	Y	€100
€100	N	€50
	Y	€150
€150	N	€100
	Y	€200
€250	N	€150
	Y	€350

Y: yes; N: no

Besides this interval WTP value in which respondents' maximum WTP value lies, after the follow-up double bounded WTP question respondents are also asked directly for their maximum WTP in an open ended question. The third part of the questionnaire ends with questions about how the WTP value should be used for different areas in the North Sea and the reasons why respondents are or why they are not willing to pay a specific bid amount.

The fourth part of the questionnaire is related to respondents' demographic and socio-economic (household) characteristics. This part is used to assess the representativeness of the sample population.

Finally, the fifth part of the questionnaire consists of a series of questions, which are used to assess the 'external' validity and reliability of especially the WTP and information part of the questionnaire. Respondents are asked how easy or difficult it was to answer the WTP questions and how clear it was what they were being asked to pay for, and what the role of the provided information was in the WTP value formulation and articulation.

4. Results

4.1 Response rate

The overall response rate is 65 percent. There are some minor differences between interview locations (see Table 4.1). The response rate is lowest in the province South-Holland (58%) and highest in Texel (75%).

Table 4.1: Number of interviews and response rates per coastal province

Interview location	Number of useable interviews	Number of non-response	Response rate (%)
North-Holland			
Zandvoort	50	22	69.4
Bergen aan Zee	44	23	65.7
Schoorl	40	14	74.0
Sub-total	134	59	69.4
Island of Texel	165	54	75.3
South-Holland			
Scheveningen	54	35	60.7
Hoek van Holland	57	70	44.9
Katwijk	59	19	75.6
Sub-total	170	124	57.8
Zeeland			
Domburg	33	18	64.7
Vlissingen	36	24	60.0
Renesse	32	18	64.0
Cadzand	30	16	65.2
Sub-total	131	76	63.3
Total	600	313	65.8

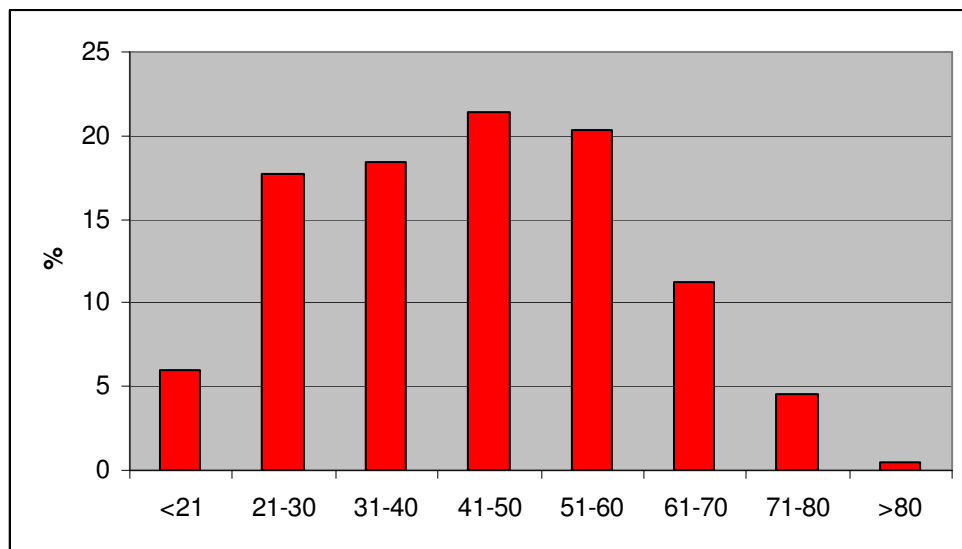
An important reason for the substantial amount of non-response are the bad weather conditions during the interview period. According to the Royal Netherlands Meteorological Institute (KNMI) the month August was by far the wettest month in the past 100 years, with a total rainfall of about 165 mm against normally 62 mm. As a result, not only the number of beach visitors was less than expected, but also visitor willingness to participate in a 10-15 minutes interview on an often windy and rainy beach.

4.2 Demographic and socio-economic characteristics beach visitors

Except for respondent age and highest education level no significant differences can be found between respondents interviewed in Zeeland, South-Holland, North-Holland or Texel in terms of their demographic and socio-economic characteristics. Hence, in the presentation below no further distinction will be made between interview location except for these two characteristics.

About half of the respondents is male (49%) and half female (51%). The average age is high: 44 years. This is also the median value, meaning that 44 years is the age of half the sample population distribution (see Figure 4.1). Respondent age varies between 16 and 87 years. As said, respondent age is significantly different between interview location³, the median value being lowest in Texel (39) and highest in Zeeland (47).

Figure 4.1: Distribution of respondents across age groups

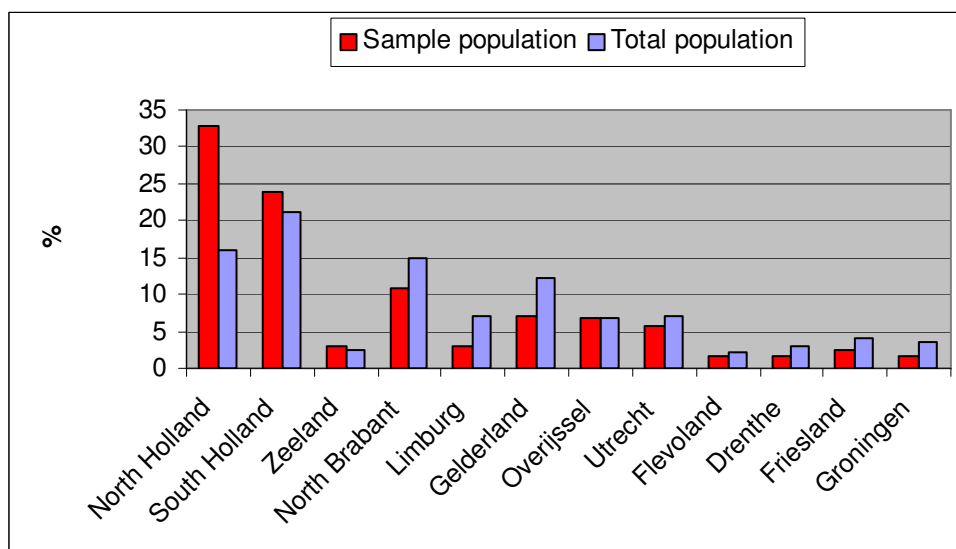


All respondents have the Dutch nationality and most are originally also born in the Netherlands (94%). Fifty percent of those who were born elsewhere, were born in Europe (Belgium, Germany, Austria, Italy). Twelve percent was born in Surinam, 6 percent in Indonesia and another 12 percent in Africa (South Africa, Zimbabwe, Zaire and Tunisia). The remaining 20 percent was born in North and South America and the former Yugoslav Republic.

³ The Chi-square outcome of the non-parametric Median test is 14.34 ($p < 0.002$).

A third of the sample population lives in the province North Holland, and is herewith heavily overrepresented in the sample population (Figure 4.2). Thirty-five percent of these North-Holland residents were also interviewed on a beach in North-Holland⁴. As expected, also the provinces South Holland and Zeeland are slightly overrepresented in the sample population. A quarter lives in South Holland and 3 percent in Zeeland. Except for Overijssel, the other provinces are slightly underrepresented in the sample.

Figure 4.2: Provinces where sample population lives



Just over fifteen percent of the sample population comes from a single person household (Figure 4.3). This is much lower than the national average where 35 percent of all households is a single person household (Statistics Netherlands, 2006). A third shares a household with one other person. The average household size is 2.9, which is slightly higher than the national average of 2.3 (Statistics Netherlands, 2006). Almost fifty percent of the multiple person households (47%) has one or more children. This corresponds with the national average of 55 percent (Statistics Netherlands, 2006).

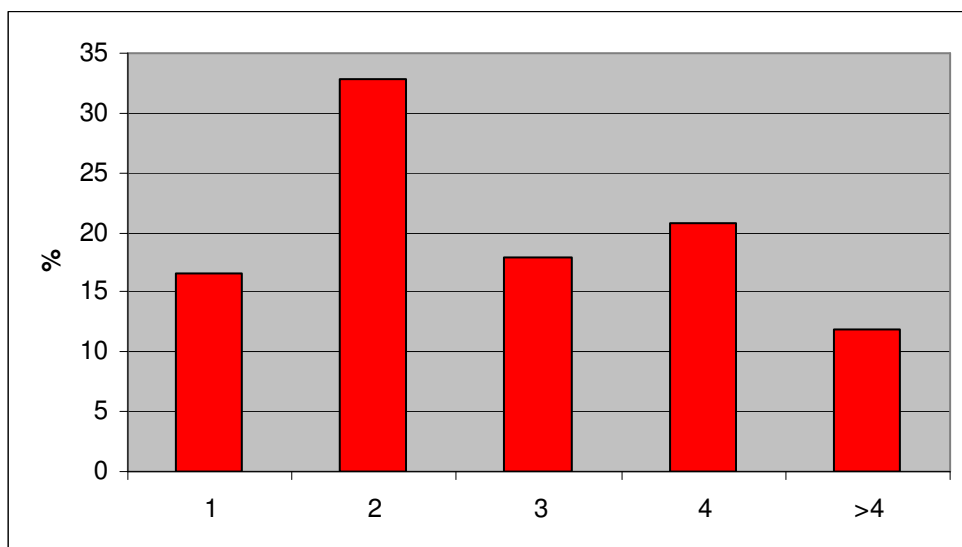
Eighty-five percent of the sample population has finished secondary school, though at different professional levels (i.e. lower, medium or higher professional education level)⁵. Only two and a half percent only went to primary school, and just over ten percent has a university degree. The median value for education level is slightly, but significantly higher in North-Holland and Texel (higher professional level) than in Zeeland and South-Holland (medium professional level)⁶.

⁴ Excluding the island of Texel, which is formally also part of the province North Holland.

⁵ Sixty percent of the total sample population followed secondary professional education, 16 percent of which at a lower, 43 at a medium and 41 percent at a higher level.

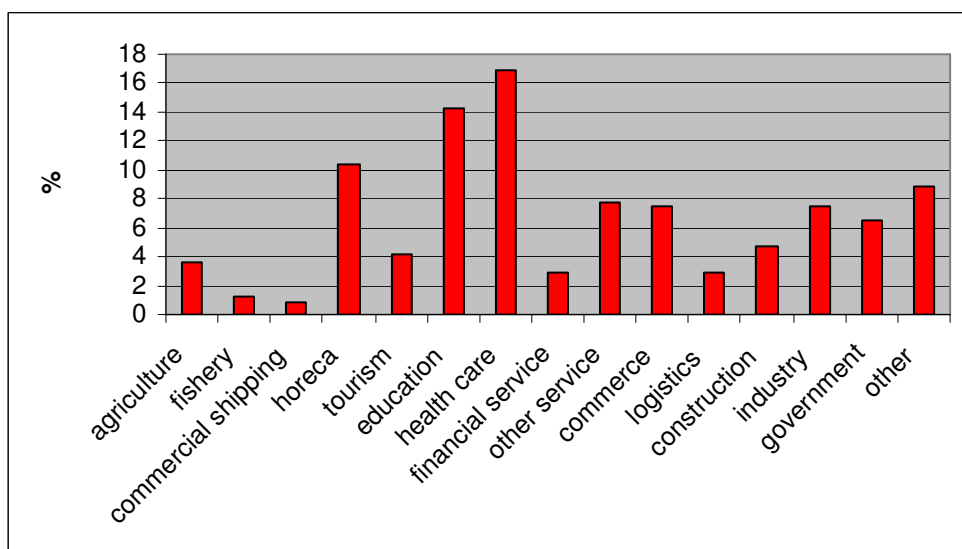
⁶ The Chi-square outcome of the non-parametric Median test is 12.18 ($p < 0.007$).

Figure 4.3: Distribution of respondents across household size



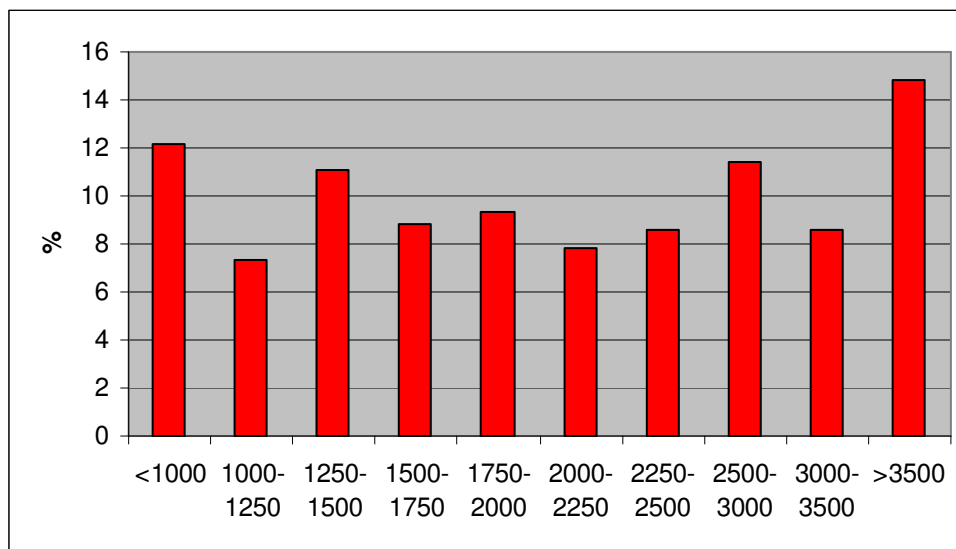
Half of the sample population (51%) is half or full time employed. Almost 15 percent is employer or independent entrepreneur. Fifteen percent of the sample population is retired and 10 percent is student. Nine percent is housewife and less than 0.5 percent is currently unemployed. The distribution of respondents across different occupational sectors is presented in Figure 4.4. A remarkably high share of the sample population is employed in health care (17%), followed by education (14%), and horeca (10%). The latter can be explained by the fact that a relatively large share of the respondents works in bars and restaurants at or near the beach (see below). The relative share of respondents employed in sectors, which are directly or closely linked to the North Sea such fishery (1%), commercial shipping (1%) and tourism (4%) corresponds more or less with their share in the total population (Statistics Netherlands, 2006).

Figure 4.4: Distribution of the sample population across occupational sector



The distribution of respondents across different income levels is fairly equal (Figure 4.5). Half the sample population has a maximum net household income of 2000 euros, while three quarters earns maximum 3000 euros per month. Fifteen percent has a net monthly household income higher than 3,500 euros. The median value is 2,125 euros per month. Average net household income is 2,275 euros per month. Multiplied by 12 this results in annual disposable income of 27,500 euros, corresponding with the national average (Statistics Netherlands, 2006). Mean income is 1,500 euro for a single person household and 2,425 euro for a multiple person household. Households with children earn net 2,700 euros per month while multiple person households without kids have significantly less, namely 2,125 euros per month.

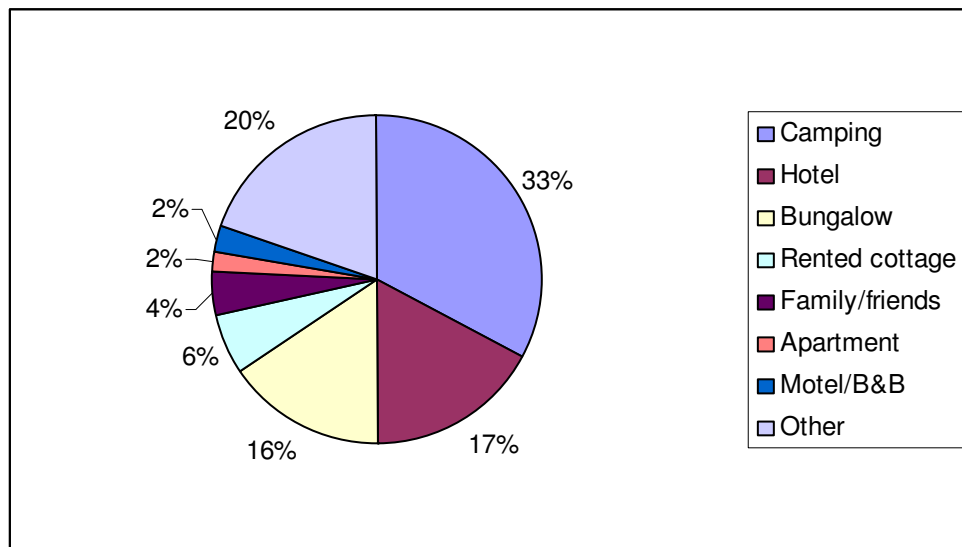
Figure 4.5: Distribution of the sample population across income groups



4.3 Beach visits and activities

Forty-two percent of all respondents are holidaymakers, the rest is on a day-trip. A third of these holidaymakers stay at a camping, just over 15 percent in a hotel and another 15 percent in a bungalow (Figure 4.6). A majority of 82 percent has visited the beach where they are interviewed before. Only one in every fifth person visits the beach for the first time. Those who visited before, have come to the beach where they are interviewed already for almost 20 years. On average, they visit the beach about 33 times per year (summer and winter). The average number of visits per year is presented in Figure 4.7.

Figure 4.6: Holiday addresses



Significant differences are found between interview locations when comparing respondents in terms of the number of days holidaymakers stay for their holidays, the number of years they already visit the beach where they are interviewed, the average number of times they visit the beach per year and the overall rating of the beach (see Table 4.2). Holidaymakers stay longest in South-Holland (3 weeks) and shortest in Texel (one week). Beach visitors in South Holland also visit more often and over a longer period of time than visitors interviewed at other locations. Beach visitors rate the beaches highest in Zeeland.

Figure 4.7: Average number of beach visits per year (summer and winter)

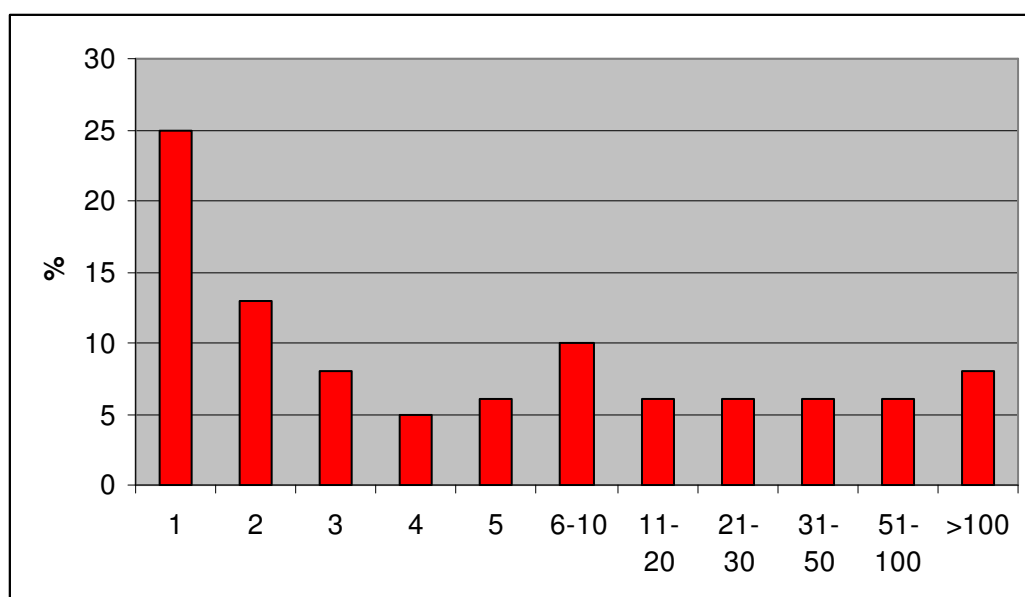
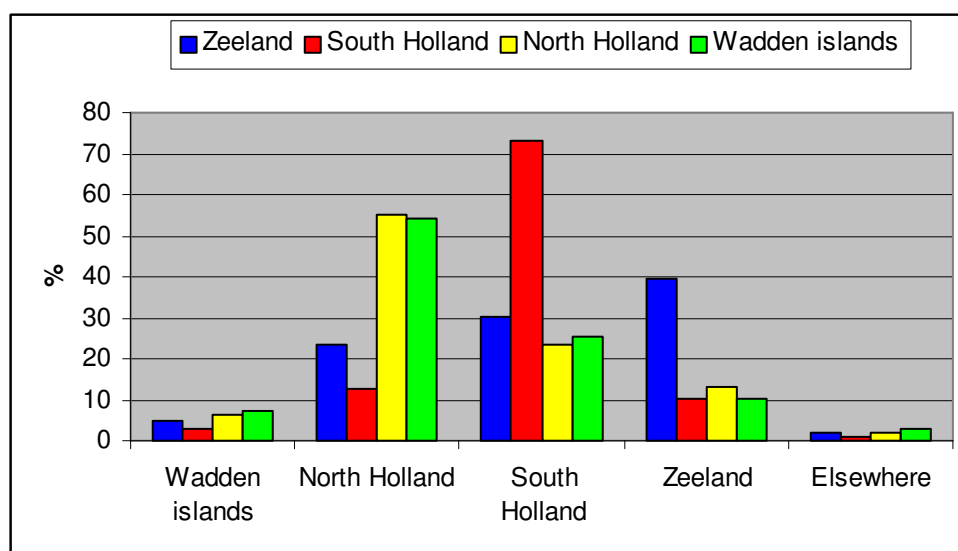


Table 4.2: Differences between respondents at different interview locations in terms of number of holidays, number of years visiting the beach, number of times visiting the beach per year and overall rating of the beach

Interview location	Number of holidays	Number of years visiting	Number of times per year	Overall rating
Zeeland	10	15	22	8.0
South Holland	20	26	48	7.5
North Holland	11	15	36	7.6
Texel	7	18	23	7.8
Total	10	20	33	7.7
Median test χ^2	12.85 ($p < 0.005$)	25.89 ($p < 0.001$)	27.15 ($p < 0.001$)	10.34 ($p < 0.020$)

Almost 70 percent of all respondents also visits other beaches than the one where they are interviewed. Most of these other beaches are found in the same province as where the beach visitor is interviewed. This is shown in Figure 4.8. For example, the most frequently visited other beaches by respondents interviewed in South Holland are found in the same province (in 73% of the cases). The same applies to respondents interviewed in Zeeland (40% of the cases) and North Holland (55% of the cases).

Figure 4.8: Location of most frequently visited other beaches by beach visitors interviewed in the provinces Zeeland, South Holland, North Holland and Wadden islands



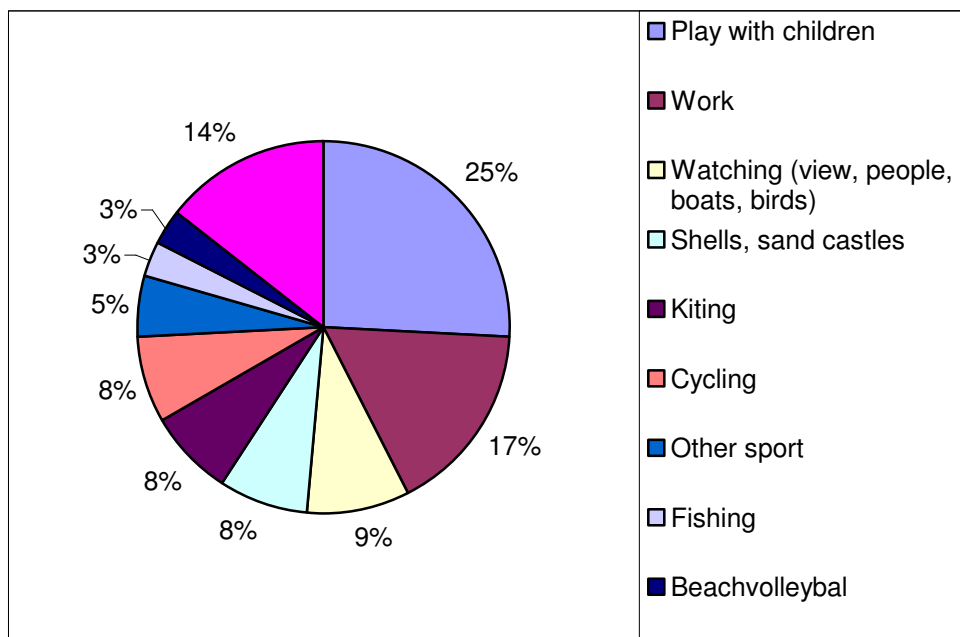
Explanatory note:

The horizontal axis presents the location of the most frequently other beaches in the provinces in which the interviews were carried out and elsewhere.

One third says that they visit these other beaches less often than the one where they are interviewed, 20 percent visits these other beaches as often as they visit the one where interviewed, and almost 50 percent says that they visit these other beaches more often. When asked to rate these other beaches, the average score is slightly less than the score for the beach where they are interviewed: 7.4.

The most important activities undertaken at beaches include visitors playing with their children, watching the view, boats, and other people, looking for sea shells, building sand castles, kiting or cycling along the beach (Figure 4.9). A remarkable high share of respondents visits the beach because they work there.

Figure 4.9: Most important beach activities

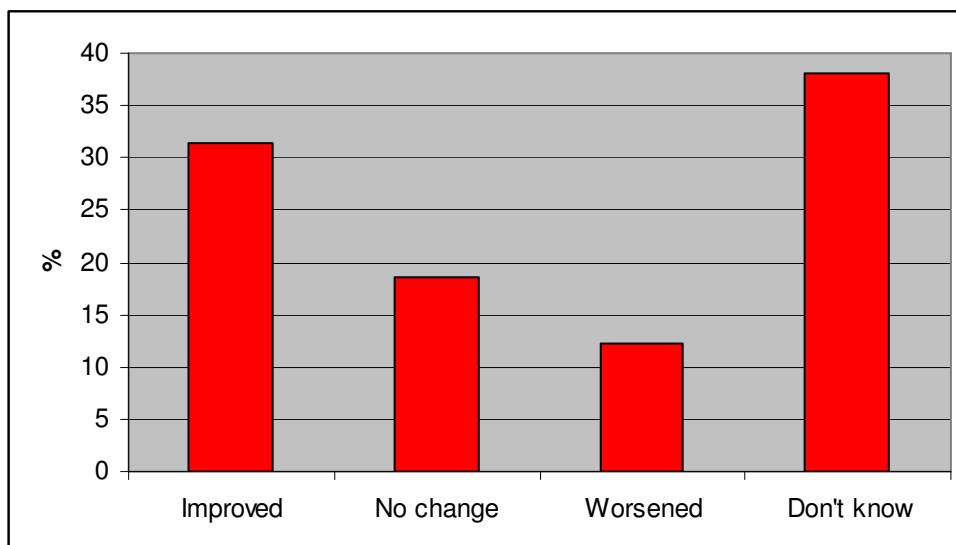


4.4 Perceptions and attitudes

When asking respondents how they perceive the North Sea water quality, just over half (52%) says it is clean. Ten percent says it is not clean, while a quarter does not know or is not sure. Small, but statistically significant differences are found between interview locations. Beach visitors in Zeeland rate North Sea water quality highest, followed by beach visitors in Texel and North Holland. Sea water quality is considered poorest in South Holland.

A relatively high share of almost 40 percent of all beach visitors is unable to say whether the water quality improved or deteriorated over the past ten years (Figure 4.10). About one third believes that the water quality has improved, whereas one in every fifth respondent says that water quality has not changed. Just over 10 percent thinks it has become worse.

Figure 4.10: Beach visitor perception of North Sea water quality changes over the past decade



Sixty-five percent of all beach visitors agrees with the statement that as visitors they bear part of the responsibility for the current state of the North Sea. A quarter disagrees with this statement, while less than 10 percent is neutral or does not know.

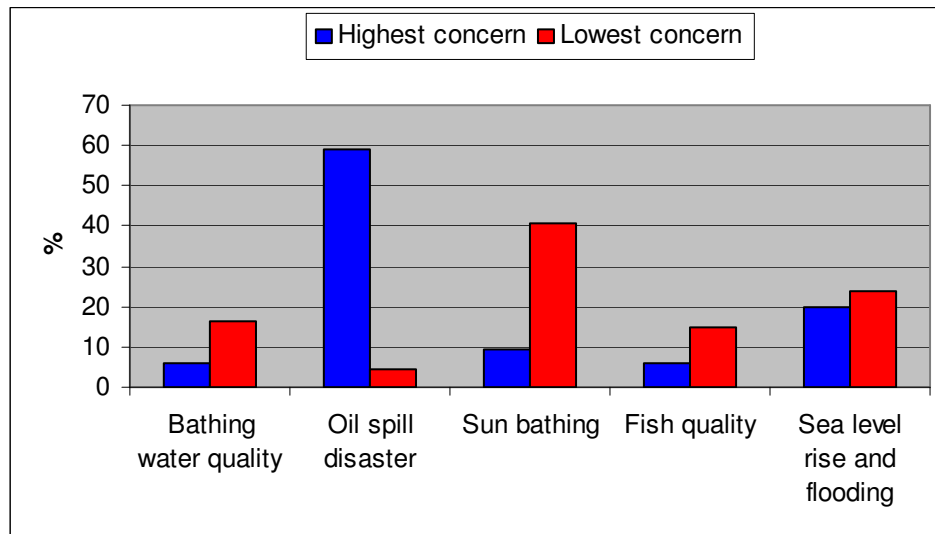
A majority of 80 percent of all beach visitors believes that the protection of the natural areas in the North Sea is equally as important as the protection of natural areas on land. Ten percent thinks that the protection of the North Sea is even more important, whereas another 10 percent says this is less important.

When asking beach visitors to state their level of concern regarding a number of possible risks either directly to their own health or the North Sea environment like bathing water quality or the quality of North Sea fish sold on the market, oil spill disasters appear to be respondents' biggest concern, followed by climate change, sea level rise and the increased risk of flooding (Figure 4.11). The health risks of sunbathing on the beach concerns respondents least, which may partly be explained by the bad weather conditions at the time of the beach interviews.

Comparing respondent replies to two separate questions about how concerned they are about bathing water quality and eating North Sea fish, a significant difference is found. Beach visitors are more concerned about the health risks associated with bathing water quality than the health risks associated with eating fish caught in the North Sea⁷. Only 13 percent of all beach visitors says never to eat North Sea fish. Over a quarter eats North Sea fish now and again, while almost 60 percent eats it regularly. Overall, 60 percent is willing to pay extra for better quality fish from the North Sea. A third is not. Slightly more respondents who eat North Sea fish regularly (70%) are willing to pay extra than those who eat fish only now and again (55%).

⁷ The Mann-Whitney Z value is -3.716 ($p < 0.001$).

Figure 4.11: Beach visitors' concern regarding several North Sea related risks

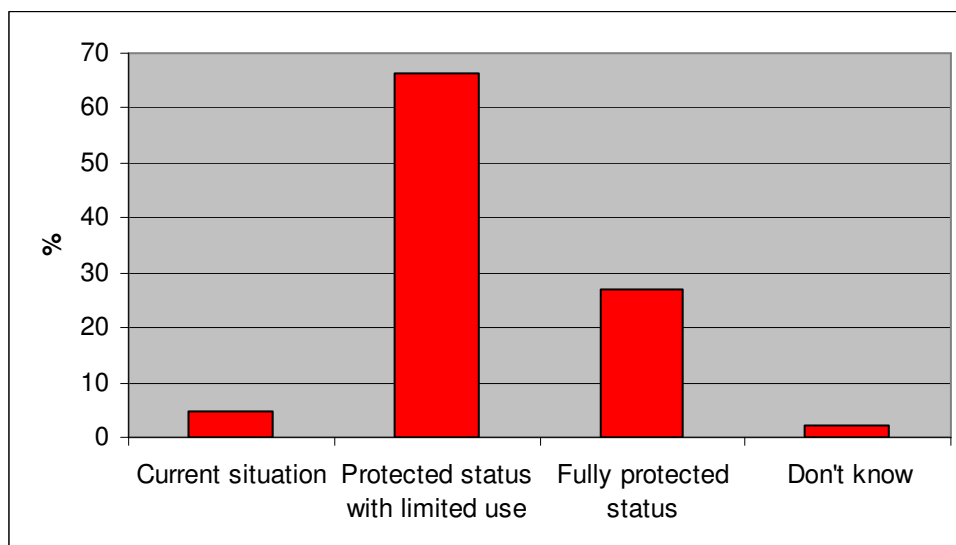


Some 38 percent of the sample population is familiar or very familiar with the presented information about the current state of the North Sea. Forty-five percent says that they have heard about it, but do not consider themselves familiar with the problem sketch. Two and a half percent claims never to have heard about the presented North Sea problems and pressures, while 14 percent says it is unfamiliar with the information provided. Less than 5 percent does not believe the presented information. Forty-two percent thinks the information is credible, and 46 percent believes the presented information completely.

Finally, when asked for their most preferred future situation, most beach visitors (66%) prefer the protected status with limited use. Just over a quarter (27%) prefers a fully protected status for the designated valuable and vulnerable natural areas (Figure 4.12). Only 5 percent prefers continuation of the current situation while 2 percent does not know.

In the next section beach visitor willingness to pay for their most preferred situation is further analyzed and the most important benefits associated with the protection and sustainable management of the North Sea.

Figure 4.12: Beach visitor preferences for the presented alternative North Sea scenarios



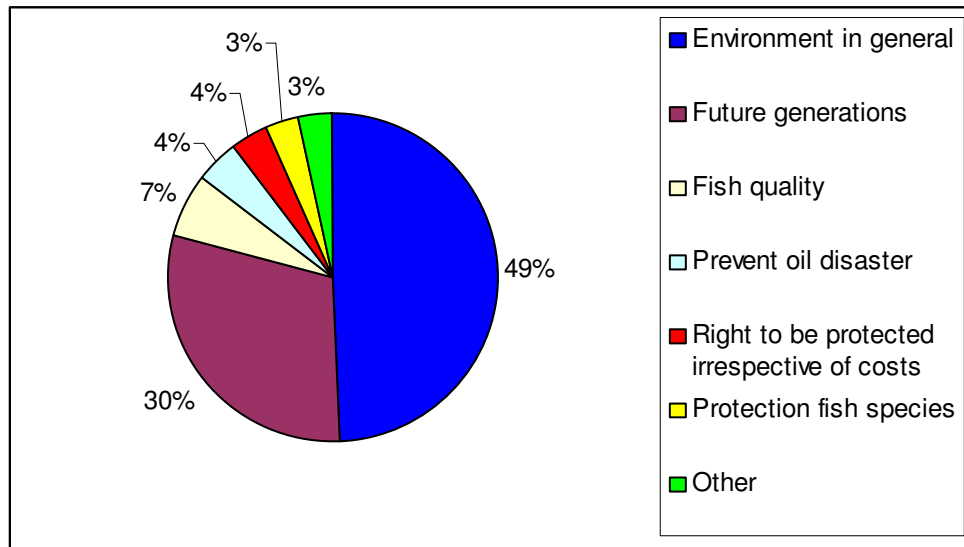
4.5 Public willingness to pay for marine protection

4.5.1 Willingness to pay and public benefits of marine protection

A majority of 72 percent of those beach visitors who prefer some level of protection of the North Sea in the future is also willing to pay for this in principle. The most important reasons why beach visitors are willing to pay is their concern for the environment in general (stated by almost 50 percent of the respondents as their main reason) and future generations (stated by 30 percent as their main reason) (Figure 4.13). Despite all efforts to focus respondents' attention in particular on the protection of specific natural areas on the North Sea (including the coast), it hence seems that general concerns about the environment and future generations dominates the responses. More North Sea specific considerations like fish and bathing water quality, prevention of oil spills, or the protection of fish and bird species do play a role in respondent replies, but to a much lesser extent than expected. Eighty percent of those beach visitors who are willing to pay in principle agree with the statement that 'money invested in the North Sea now will pay itself back in the long term'.

The results above could be interpreted as indicative of having elicited primarily some general commitment to an environmental cause instead of a specific to the North Sea related economic value. However, less than one percent of those stating a positive WTP in principle for their most preferred future situation of the North Sea state that they are willing to do so because they like to give to good causes. Also the presence of possible lexicographic preferences are dismissed based on the finding that less than 4 percent of the sample population feels that the North Sea has a right to be protected irrespective of the costs to society.

Figure 4.13: Most important reasons for a positive WTP



A similar result is found when analyzing responses to the question which types of values are considered most important for willing to contribute to the protection and sustainable management of the North Sea. A quarter considers use and non-use values equally important, where use values are described as ‘the value attached to my own health in relation to bathing in the North Sea and eating fish from the North Sea’, and non-use values as ‘the value attached to nature, wildlife and the environment and future generations’. Thirty percent says that these latter non-use values are most important, whilst 38 percent considers them more important than use values. A significant difference is found here between beach visitors who prefer a future protected status with limited use and beach visitors who prefer a fully protected status⁸. The latter score higher on the applied use versus non-use scale than the former⁹.

⁸ The Mann-Whitney Z value is -4.808 ($p < 0.001$).

⁹ Respondents were asked to rate the most important reason why they are willing to pay for the protection of the North Sea using the following semi-itemized rating scale:



4.5.2 Reasons why people do not want to pay

The reasons why beach visitors refuse to pay in principle for their most preferred future situation are presented in Table 4.3. A distinction is made between economically expected reasons, resulting in so-called legitimate ‘zero bids’, and protest reasons, that is reasons where respondents basically protest against the imposed market construct by the hypothetical WTP question (see for example Jorgensen et al., 1999 or Meyerhoff and Liebe, 2006). Typical protest reasons include ‘the polluter or beneficiary should pay’, or respondent disbelief that the money will actually be spent for the good or cause at hand. In this study, most protesters (about 50%) argue that the North Sea should be protected by law, not by asking people to pay for its protection. This is followed by the polluter should pay.

Table 4.3: reasons why beach visitors are not willing to pay for the protection and sustainable management of the North Sea

Reason why beach visitors are not willing to pay	Share of total refusals (%)
<i>Economically expected reasons</i>	
Preference for continuation of the current situation	2.7
Protection not important	1.1
Income too low	12.4
Current situation good enough	2.2
Other things more important	3.8
Reallocation current tax money	50.5
Other reason	5.3
Sub-total	78.0
<i>Protest reasons</i>	
Protection through law, not by asking people to pay	10.8
Polluter should pay	8.1
Other protest reason	3.1
Sub-total	22.0
Total	100.0

A large share of ‘protest bidders’ may seriously invalidate the CV study and WTP question for this specific environmental problem or issue. However, the share of protest bids is relatively limited in this case study compared to the total sample size. Although one in every fifth refusal is based on a protest reason as shown in Table 4.3, the share of protest

reasons in the whole sample is less than 7 percent (6.8%). This low rate is considered an important indicator for the study's acceptability (see Brouwer (2006) for guidelines on acceptable protest rates).

Looking at the economically expected reasons, these typically relate to low or no preferences, meaning that the good has little or no incremental value to the respondent in question, or income constraints and the availability of substitution goods, also implying that the respondent in question prefers to spend his limited income on other things than the proposed management measures to protect the North Sea. This too is interpreted that the marginal value of the proposed environmental changes is zero. In this case study, a reallocation of current tax money is stated most often (in 50% of the cases) as the main reason why respondents refuse to pay for their most preferred future North Sea scenario. This means that respondents value the good in question (i.e. their preferred future situation), but that they are not willing to trade-off and spent extra money on it. The economically expected reasons are converted in zero bids in the analyses presented below. Protest bidders are excluded from further analysis.

Given the low number of protest bidders (n=42), no meaningful statistical analysis is possible of possible demographic, socio-economic and attitude or perception based characteristics between protest and non-protest bidders. Protest bidders are slightly more often female (57%) with an average age of 42 years. They are furthermore more or less equally distributed across interview locations, education and income levels.

4.5.3 Average willingness to pay

Mean WTP measures for dichotomous choice WTP responses are inferred from the statistical cumulative probability distribution function (CPDF) (Hanemann and Kanninen, 1999). Different mean WTP values can be calculated depending on the statistical specification and estimation of the bid function and the applied truncation strategy. In this study, we use both parametric (logistic) and non-parametric (Turnbull) estimation methods, with the latter estimator yielding a lower bound on WTP (Haab and McConnell, 1997).

The reduced form of the logistic probability or logit model is (e.g. Langford and Bate-man, 1993):

$$\Pr[y_i=1] = \frac{e^{\beta'x}}{1 + e^{\beta'x}}$$

where $\Pr[y_i=1]$ is the probability that a respondent says 'yes' to a specific bid amount. Beta (β) is a vector of variable parameters to be estimated, while x is the corresponding vector of explanatory variables. The error terms of the logit model are assumed to be normal distributed with zero mean and variance of one. Mean WTP is found by dividing the estimated constant by the negative of the slope parameter belonging to the bid vector (Hanemann, 1984).

An important problem when using referendum type of models is the possibility of negative WTP (e.g. Hanemann, 1989; Johansson *et al.*, 1989). The distribution of WTP also has a negative tail, unless the CPDF is truncated so as to include positive bids only or

bids are transformed into their logarithmic form. However, also in these cases, the problem may persist. In those cases where negative WTP is neither expected nor plausible, the non-parametric Turnbull estimator has been proposed as an alternative solution to the parametric model presented above (Haab and McConnell, 1997). The Turnbull estimator is based on a grouping of binary responses in bid intervals. In order to guarantee non-negative outcomes for WTP, the probability of WTP responses is constrained to be positive and sum to unity across bid intervals. Furthermore, a monotonically increasing CPDF is guaranteed by pooling intervals where needed. Mean WTP can be calculated as the sum of the probabilities of respondent voting behaviour times the various bid levels used. An attractive feature of the approach is the use of the lower bound of each interval in order to estimate a conservative lower bound WTP (Carson *et al.*, 1994):

$$E(WTP) = \sum_{i=1}^{m+1} P_i * B_{i-1}$$

where P_i is the probability of respondents voting 'no' in the bid interval $[B_{i-1}, B_i]$, B_{i-1} the lower bound bid level, and m the maximum bid. The probability of respondent voting behaviour in the constructed intervals (P_i) is calculated as the difference between the proportion of respondent voting behaviour across the two bid levels B_{i-1} and B_i :

$$P_i = N_i - N_{i-1} = \frac{n_i}{n_i + y_i} - \frac{n_{i-1}}{n_{i-1} + y_{i-1}}$$

where n_i is the number of 'no' votes to bid level B_i and y_i the number of 'yes' votes to bid level B_i . The lower bound estimate can be applied if the probabilities of voting behaviour in constructed intervals are based on 'no' responses. An upper bound can also be determined if all respondents offered the largest bid amount respond 'no' and hence the upper bound takes on a finite value.

The single bound logistic regression and double bound Turnbull estimation results for both future North Sea scenarios are presented in Table 4.4. The mean WTP value based on the estimated single bound logit model is calculated following conventional procedures for binary WTP response data (Hanemann, 1984) and is, as expected, significantly higher than the Turnbull estimator. The average WTP value based on the single bound dichotomous choice model is the same as the average value found based on the same elicitation format for the implementation of the WFD in the Netherlands in 2003 and reaching a good ecological status of all freshwater bodies (Brouwer, 2004).

As can be seen from the relative size of the calculated standard errors and the 95 percent confidence intervals, the double bound average WTP estimate is much more accurate than the single bound average WTP estimate. Standard errors of the Turnbull WTP values are calculated based on bootstrap procedures (e.g. Efron and Tibshirani, 1993).

Table 4.4: Average WTP results (in €/household/year) for both North Sea future scenarios together based on two different estimation methods

	Single bound Linear-logistic estimation	Double bound (interval) Turnbull estimation
Mean WTP	104.5	44.0
Standard error	27.6	3.2
95% confidence interval	50.4 – 158.6	37.8 – 50.3
Number of observations	553	349

The corresponding CPDF is presented in Figure 4.14. Figure 4.14 shows that just over 70 percent of all beach visitors is willing to pay the lowest start bid of 5 euros per household per year in terms of additional income taxation and just over 50 percent also 10 euros per year. However, less than 10 percent is willing to pay 75 euros and less than 5 percent 100 euros. The acceptability rate of the highest bid amount of 250 euros is less than one percent.

Figure 4.14: WTP cumulative probability distribution function

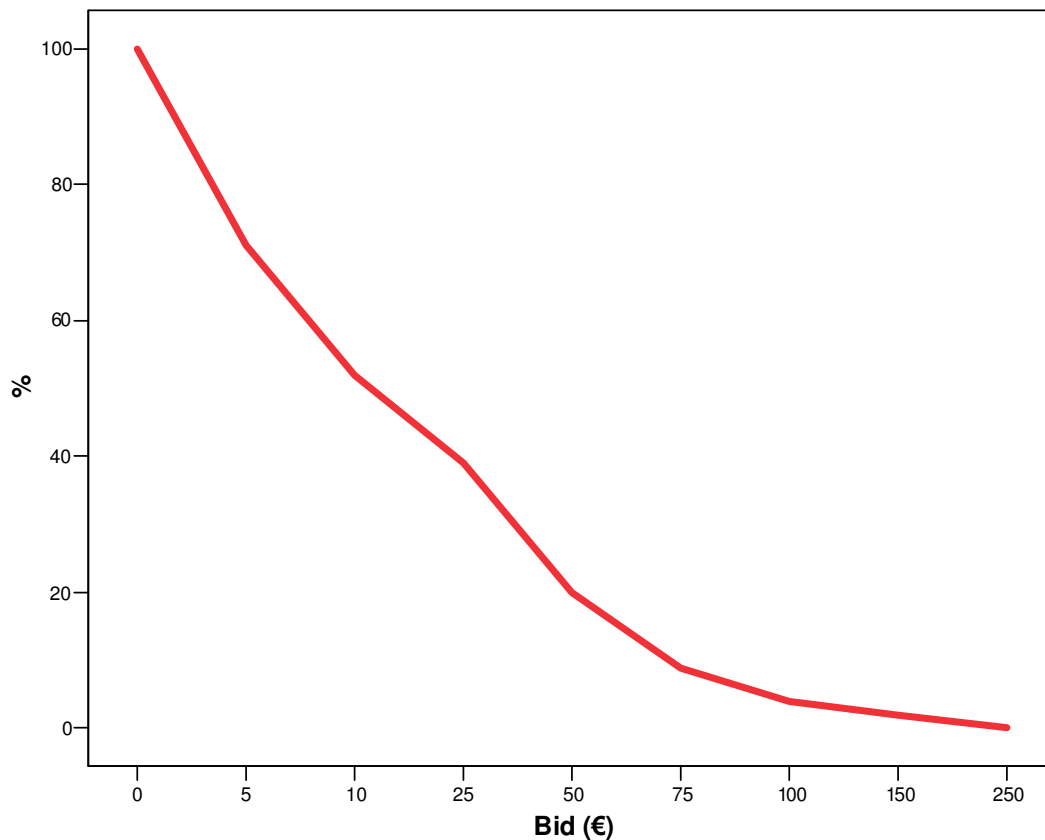


Table 4.5 presents the average WTP values for the two North Sea scenarios separately based on the lower bound Turnbull estimates only in view of the fact that these produce more conservative and more accurate estimations of mean WTP. A statistically significant difference is found between the two valuation scenarios. Although a majority of 66 percent of all beach visitors prefer a North Sea with natural areas having protected status with limited use, beach visitors who prefer a fully protected status for the designated valuable and vulnerable natural areas are willing to pay significantly more. However, the latter mean WTP estimate is less accurate than the estimate for limited use, largely due to the substantially lower number of observations. The confidence interval for limited use is smaller than for no use at all. As in Table 4.4, the standard errors are computed based on non-parametric bootstrap procedures.

Table 4.5: Average double bound WTP results (in €/household/year) for both North Sea future scenarios separately

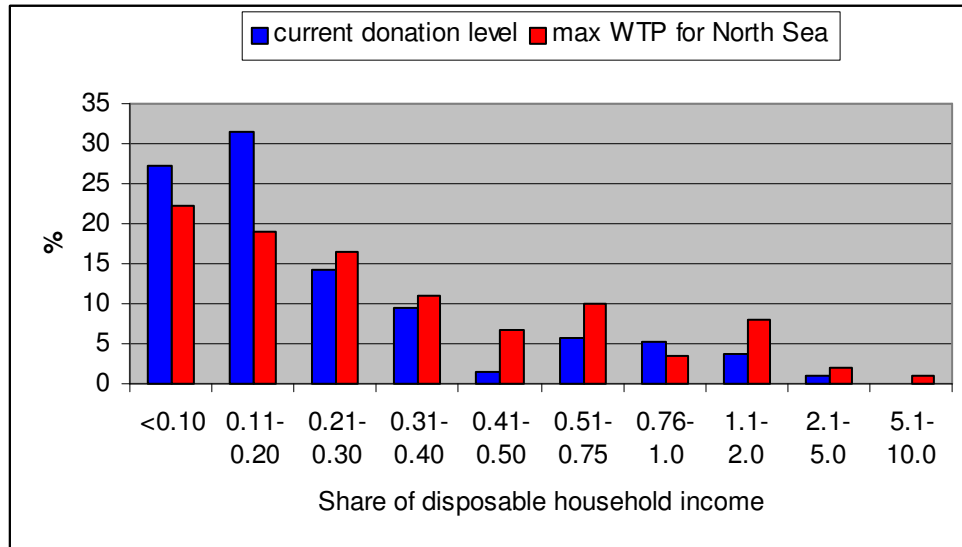
	Protected areas with limited use	Fully protected areas
Mean WTP	43.1	53.5
Standard error	3.7	8.1
95% confidence interval	35.8 – 50.5	37.6 – 69.5
Number of observations	234	80

Following the double bounded DC WTP questions, used to determine the interval in which respondent maximum WTP falls, respondents were also asked for their maximum WTP explicitly in an open-ended question. This yields another 394 observations ranging from 5 to 2,200 euros per household per year. Comparing these maximum WTP values with respondent household income, the respondent stating a maximum WTP of 2,200 is identified as an outlier, using 10 percent as an arbitrary cut-off point. The distribution of the share of stated maximum WTP in respondent household income is presented in Figure 4.15 and compared with the actual level of donations of beach visitors to environmental protection organizations such as World Wildlife Fund (WWF), Greenpeace, the Society for Natural Monuments (Natuurmonumenten), or the Society for the protection of Birds (Vogelbescherming Nederland).

Most respondents (60%) state a maximum WTP value, which does not exceed more than 0.3 percent of their annual household income. Seventy-five percent is not willing to pay more than 0.5 percent of their annual household income. Ten percent is willing to give up between 0.5 and 0.75 percent of his household income for the protection and sustainable management of the North Sea. Eight percent is willing to pay between 1 and 2 percent and only one percent between 5 and 10 percent of his annual household income. Compared with beach visitors' actual donation level, a small, but statistically significant difference is found¹⁰. The relative share of beach visitor WTP for the protection of the North Sea is on average higher (0.48% of their annual household income) than the share of their current donations (0.30% of their annual household income).

¹⁰ The Mann-Whitney Z value is -2.890 ($p < 0.004$).

Figure 4.15: Distribution of maximum WTP values for the North Sea as a percentage share of annual household income



No significant difference can be detected in terms of actual absolute donation level to environmental protection organizations between beach visitors who prefer a protected status of the North Sea with limited use (average donation equal to 73 euros per year; median value equal to 48 euros) and who prefer a fully protected status (average donation equal to 87 euro; median value equal to 50 euros). However, a significant difference does exist in terms of their average maximum WTP¹¹. Corresponding with the results presented in Table 4.5, Table 4.6 shows that average maximum WTP is higher for a fully protected status than for a protected status with limited use.

Table 4.6: Average maximum WTP results (in €/household/year) for the two North Sea scenarios

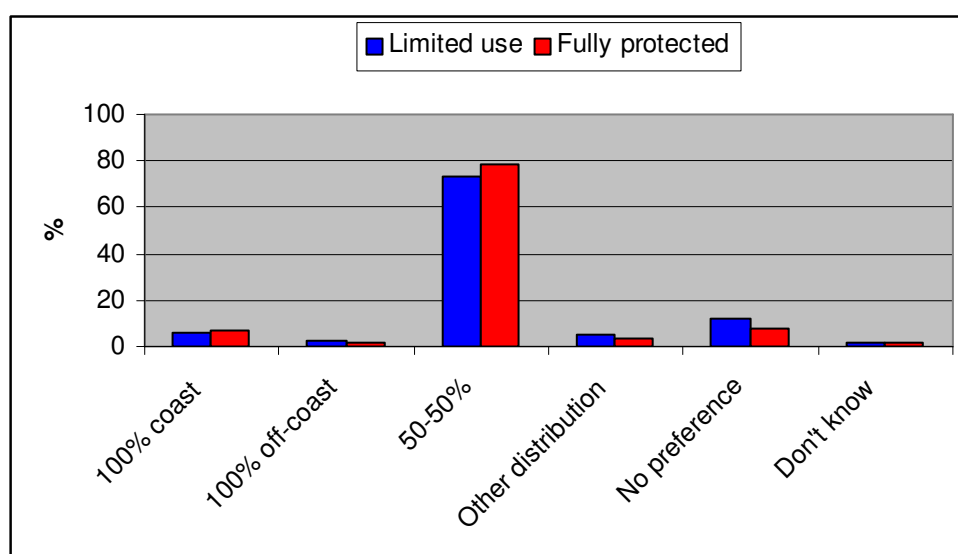
	Protected areas with limited use	Fully protected areas
Mean WTP	106.1	149.7
Standard error	11.2	21.8
95% confidence interval	84.1 – 128.1	106.5 – 192.9
Median WTP	50.0	75.0
Number of observations	272	110

In order to further test the presence of use and non-use values in estimated WTP amounts, respondents were not only asked whether they prefer a protected status with or without (limited) use, but also where they prefer this money to be spent: on the protection of the coastal area that they currently visit or the protection of the natural areas located further away off-coast, which they will never visit. No significant differences are

¹¹ The Mann-Whitney Z value is -1.885 ($p < 0.059$).

found between beach visitors who prefer a protected status with limited use and beach visitors who prefer a fully protected status (Figure 4.16). About three quarters wants their stated WTP to be allocated equally between the coastal area and the off-shore natural areas. Only 6 percent wants their stated WTP amount to be spent completely on the protection of the coast, and 3 percent completely on the protection of the off-shore areas. Just over 10 percent has no preference.

Figure 4.16: Preferred allocation of stated WTP over coastal and off-coast areas by respondents who prefer a protected status with limited use and a fully protected status



Finally, when asking beach visitors how they prefer to pay (income taxation being the payment vehicle for the double bounded and open-ended WTP questions), the pretest results are confirmed that income taxation is the most preferred mode of payment by almost half the sample population, followed by a one-time-off donation (16%) and water board taxes (9%). Eighteen percent has no preference for any specific payment mode. Five percent prefers to pay through municipal taxes and 3 percent through an increase of the tap water price.

4.5.4 Factors determining willingness to pay

Factors that have a significant impact on stated WTP are analyzed through interval regression techniques using the statistical software Stata (see for example Hanemann et al., 1991 or Alberini, 1995 for a more detailed exposition about the underlying statistical assumptions and methods). The left-hand side of the conventional WTP function:

$$WTP_i = x_i\beta + \varepsilon_i \quad (1)$$

where x_i is a vector of individual characteristics, β the corresponding vector of unknown parameter estimates and ε_i is a normal error term with mean zero and variance σ^2 , con-

sists in this case of the following pairs of observations or response categories (e.g. Alberini, 1995):

$$\begin{aligned} \text{WTP}_{\text{no, no}} &= \pi_i(\text{nn}) \\ \text{WTP}_{\text{no, yes}} &= \pi_i(\text{ny}) \\ \text{WTP}_{\text{yes, no}} &= \pi_i(\text{yn}) \\ \text{WTP}_{\text{yes, yes}} &= \pi_i(\text{yy}) \end{aligned}$$

where $\pi_i()$ is the contribution of each interval to the log-likelihood function. Regressing these intervals on a number of possible explanatory factors, including standard individual demographic and socio-economic characteristics, attitude and perception based variables and method-based factors, the statistically best-fit model presented in Table 4.7 results.

All effects are statistically significant at the ten percent level except one of the dummy variables representing interview locations. The significance of the overall model fit is confirmed by the outcome of the Wald test. The total number of observations is lower than the original number of interviews because of the exclusion of protest bids and missing values. The calculated pseudo R-square is used here as a rough indicator of overall model fit. The statistic is not very high, but lacks the straightforward interpretation of explanatory power. Standard errors are corrected for possible heteroscedasticity using the Huber-White estimator of variance. Possible correlation between explanatory variables is tested using Pearson correlation coefficients.

As expected and confirming the univariate results presented in section 4.5.3, beach visitors who prefer a fully protected status of the North Sea are also willing to pay significantly more than respondents who prefer a protected status with limited use whilst controlling for other explanatory factors (i.e. *ceteris paribus*). Household income also has, as predicted by economic theory, a positive impact on stated WTP, meaning that willingness to pay is constrained by ability to pay. The probability of accepting a specific bid amount is *ceteris paribus* significantly higher the higher beach visitors household income. As observed in the international literature, a significant positive anchoring of stated WTP on the start bid is found in this study.

Besides household income, only respondent membership of an environmental protection organization was found to significantly influence stated WTP as another individual socio-economic characteristic. Respondent place of residence (near the North Sea or not), age, gender, household size, household composition (including children) or em-

ployment (including sector¹²) has no significant impact on stated WTP. The probability of stating a positive WTP to a specific bid level also increase significantly if swimming is the most important reason for respondents to visit the beach.

An interesting geographical effect is found. The further north along the North Sea beach visitors are interviewed, the lower stated WTP, whilst controlling for possible influencing factors including beach visitor demographic and socio-economic characteristics. The southern province of Zeeland is taken as the baseline province. The results in Table 4.7 show that the probability of beach visitors in North Holland and Texel saying yes to a specific bid amount is significantly lower, *ceteris paribus*, than for beach visitors in Zeeland. The same applies for South Holland, but this effect is statistically not significant at the 10 percent level. The negative effect increases the further north the beach visitors are interviewed.

Finally, as in previous water valuation work (Brouwer, 2006), a significant effect is found when respondents struggle with the WTP questions. The harder they find it to answer the WTP questions, the lower *ceteris paribus* the probability that they are willing to pay a specific bid amount. At the same time, a significant information effect is found where the probability of stating a positive WTP increases with respondent perception of the quality of the presented information during the interview.

4.5.5 Total economic value

The total economic value is found in theory by aggregating the average WTP value across all North Sea beach visitors in the Netherlands, assuming that the sample population in this study is representative for the whole population of beach visitors. In view of the fact that information about the total number of households that visits the North Sea coast beaches is lacking, let alone information about their most preferred future North Sea scenario, it is impossible to calculate a total economic value aggregated across the whole population from which the sample was drawn, unless some assumptions are made. Assuming, for example, that half of all Dutch households visit at some point one or more beaches along the North Sea coast, and taking the average WTP value for both valuation scenarios together, a total annual economic value of about 150 million euros results. Discounted for example over a 10-year time period at a conventional discount rate of 4 percent, a total present value is found of 1.2 billion euros.

¹² Separate tests were carried out to see whether employment in tourism and fishery, health care, education, government or industry has any influence on stated WTP, but none of these passed the 10 percent threshold value. Also tested was, for example, whether a respondent is retired or self-employed or whether someone is on holiday or not at the time of the interview. Other variables tested for their significance, but which appear to play no role of significance include: beach visitor perception regarding current sea water quality and the evolution of sea water quality over the past decade, their main motivation to state a positive WTP (including use and non-use motivations), their familiarity and perception of the information presented during the interview, the impact of this information on stated WTP in terms of constructed preferences, respondent concern about sea water quality, possible North Sea risks, including fish quality, oil spills etc., the relative importance attached to protection of the North Sea, whether they eat North Sea fish, how often they visit the beach and how certain they are they will visit the beach again in the future.

Table 4.7: Multivariate interval regression results

Explanatory factor	Value range	Parameter estimates
Constant	-	-81.381** (41.595)
<i>Theoretically expected factors</i>		
Most preferred future situation	Dummy (1=fully protected)	13.384* (7.139)
Household income (net, monthly)	€750-4500 (natural log)	13.811*** (5.309)
<i>Other socio-economic characteristics</i>		
Member of or donator to an environmental protection organization	Dummy (1=member/donator)	21.863*** (6.175)
Main beach activity=swimming	Dummy	27.562*** (9.979)
<i>Methodological factors</i>		
Starting bid	€5-250	0.649*** (.050)
Interview location=South Holland	Dummy	-11.555 (8.513)
Interview location=North Holland	Dummy	-19.176** (9.171)
Interview location=Texel	Dummy	-20.559** (8.639)
Quality of the presented information	0-3 (0=completely insufficient; 3=more than sufficient)	14.896*** (5.680)
Difficulty answering the WTP questions	0-4 (0=not difficult at all; 4=very difficult)	-11.283*** (3.194)
Scale parameter (σ)	-	3.966*** (.063)
Log Likelihood		-621.255
Wald test (Chi-square)		259.07 (10df) ($p < 0.001$)
Pseudo R-square		0.15
Number of observations		465

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

4.5.6 External validation checks

Although the questionnaire was thoroughly pretested through 70 face-to-face interviews, external validity checks are nevertheless included to assess respondent experiences answering especially the WTP questions. Besides the important protest rate a number of additional indicators are used to evaluate the external validity of the CV study. External validity refers to the extent to which the imposed economic valuation task is considered by those who participate in it as valid and legitimate, and hence the results reliable. The indicators are summarized in the figures below.

Respondents are asked how difficult they find it to answer the posed WTP questions (Figure 4.15) and how clear it is what they are asked to pay for exactly (Figure 4.16). Other questions relate to the impact of the presented information, whether respondents feel the quantity and quality of the information suffices to answer the WTP questions (Figure 4.17) and what the impact of the provided information is on their stated WTP (Figure 4.18).

Figure 4.15: Difficulty experienced in answering the WTP questions

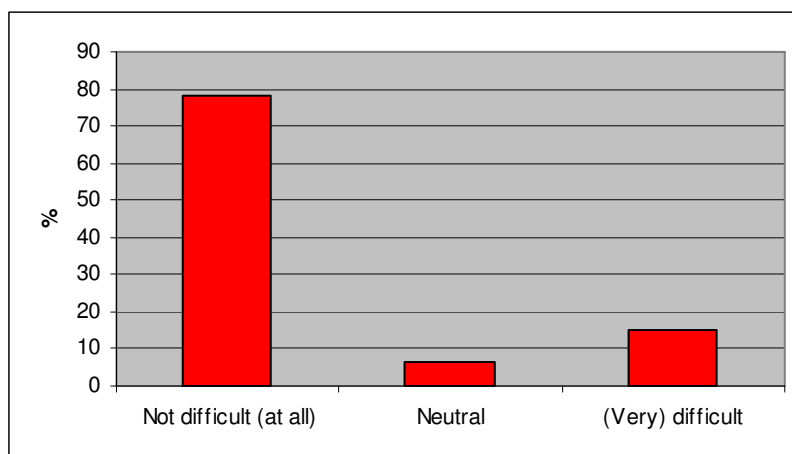


Figure 4.16: Clarity of the WTP questions

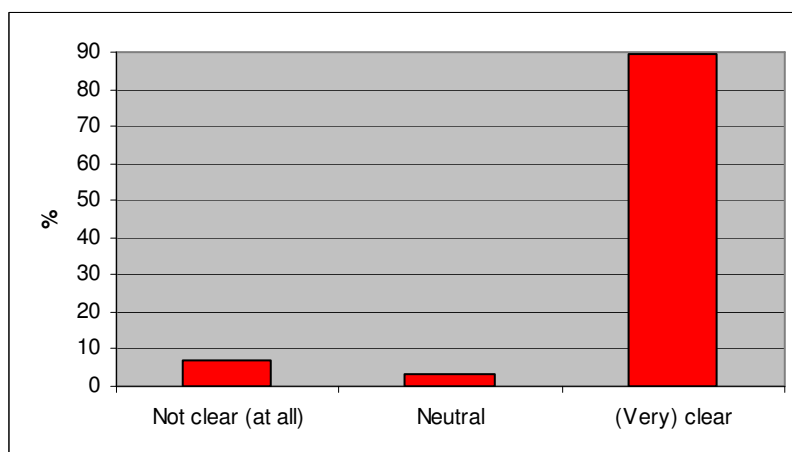


Figure 4.17: Extent to which presented information is considered sufficient to answer the WTP questions

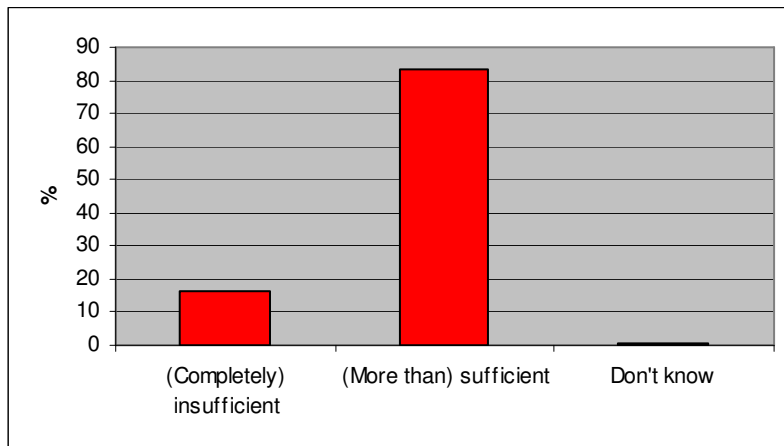
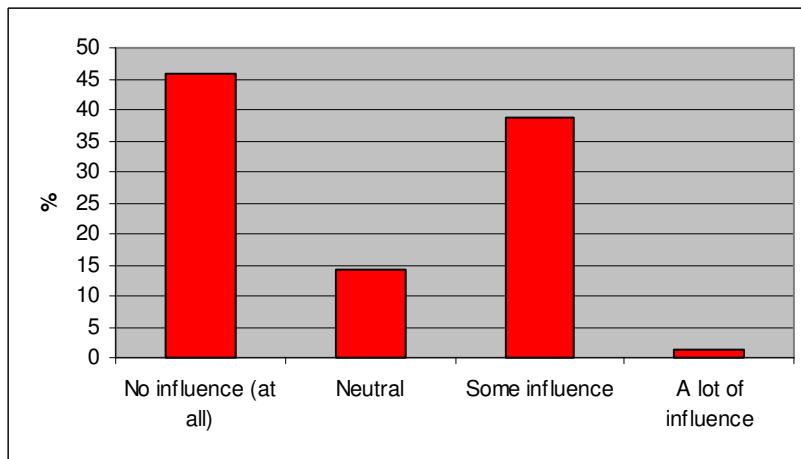


Figure 4.18: Impact of the presented information on stated WTP



As can be seen from the figures above, a majority of almost 80 percent of the respondents indicates to experience no problem answering the WTP questions. Ninety percent says that it is clear what exactly they are being asked to pay for, and more than 80 percent feels that the presented information is sufficient or even more than sufficient to answer the WTP questions. Finally, 45 percent claims that the presented information has had no influence on their stated WTP. Almost 40 percent says that it has influenced their WTP somewhat. Only one percent claims that the presented information has had a lot of influence on their WTP reply.

5. Conclusions

The main objective of this study is to assess the public benefits associated with the protection and sustainable management of the North Sea. For this purpose, 600 face-to-face beach interviews were carried out with a non-representative sample of beach visitors in August 2006 at 10 different beaches along the Dutch North Sea coast and on the island of Texel, using a structured questionnaire design. Besides a baseline scenario, respondents were presented with two possible future development scenarios for the protection and sustainable management of the North Sea: one where ecologically valuable and vulnerable areas are designated as protected marine parks with limited economic activity and one where the same areas are fully protected and no economic activities are allowed at all.

Half of the interviewed beach visitors believe that the seawater is currently clean. Ten percent says it is polluted, while a quarter does not know. Some small differences are found between interview locations in the three coastal provinces and on the island of Texel. Forty percent of the beach visitors have no idea how seawater quality has changed (or not) over the past 10 years. One third believes that the seawater quality has improved, while 20 percent thinks it has not changed and 10 percent thinks it has deteriorated. Nevertheless, a majority of 80 percent of all beach visitors believes that the protection of the natural areas in the North Sea is equally as important as the protection of natural areas on land. Ten percent thinks that the protection of the North Sea is even more important, while another 10 percent says this is less important. Most beach visitors prefer a protected status with limited use. Just over a quarter prefers a fully protected status for the designated valuable and vulnerable natural areas. Only 5 percent prefers continuation of the current situation.

A majority of 72 percent of those beach visitors who prefer some level of protection of the North Sea in the future is also willing to pay for this in principle. The most important reasons why beach visitors are willing to pay is their concern for the environment in general and future generations. Average willingness to pay per household per year varies between 43 euros for protected areas with limited use and 53 euros for fully protected areas. These money amounts are higher than the average values found for public willingness to pay for improved bathing water quality as in the revised European Bathing Water Directive (€25/household/year), but substantially lower than average WTP for the implementation of the WFD in the Netherlands (€105/household/year) (Brouwer, 2006).

As discussed in the literature, the double bounded dichotomous choice CV results are statistically more efficient in terms of accuracy measured through their variation coefficient than the single bound estimates. The study also shows that corresponding previous CV findings the maximum open-ended WTP findings are significantly higher (2.5 to 2.8 times) than the double bounded dichotomous choice results. The open-ended and double bounded DC estimates do not differ much in terms of their accuracy. Variation coefficients range between 9 and 15 percent.

Comparing the stated open-ended WTP amounts with respondent household income, most respondents (60%) state a maximum WTP value, which does not exceed more than

0.3 percent of their annual household income. Seventy-five percent is not willing to pay more than 0.5 percent of their annual household income. Compared to beach visitors' current level of donations to environmental protection organizations, the share of stated maximum WTP in household income is slightly, but significantly higher. Currently, about 0.3 percent of annual household income goes as donations or membership fees to environmental protection organizations such as WWF, Greenpeace or the Dutch Society for Nature Monuments. Respondents are willing to pay additionally and on average almost 0.5 percent extra just for the protection of the North Sea.

As for the double bounded CV results, also the open-ended WTP results show that average WTP is significantly higher for a fully protected status with no economic use than for a protected status with limited use. Hence, stated WTP seems to consist for a large part of non-use value. Although as much as 90 percent of the respondents say that they know exactly what they are being asked to pay for, most respondents are primarily motivated by a concern about the environment in general. Also concern about the environmental legacy of the current generation to future generations plays a role.

These clearly are non-use motivations and are also measured explicitly on a separate scale. Thirty percent consider non-use the most important value for their stated positive WTP, while almost 40 percent say that non-use values are more important than use values. A quarter of all beach visitors who are willing to pay in principle for the protection and sustainable management of the North Sea attach equal weights to use and non-use values. Concerns about having measured something like 'moral satisfaction' are dismissed by the finding that when asked explicitly less than one percent of those respondents stating a positive WTP say that their main reason is that they like to give to good causes. A majority of 65 percent of all beach visitors feels co-responsible for the current state of the North Sea.

Another attempt to make the difference between use and non-use values more explicit by asking beach visitors to allocate their stated WTP across the coast they currently visit (suggesting use value) and further off-coast located ecologically sensitive areas (suggesting non-use value) yields more mixed results. Three quarters want their stated WTP to be allocated equally between the coastal area and the off-shore natural areas. Only 6 percent wants their stated WTP amount to be spent completely on the protection of the coast and 3 percent completely on the protection of the off-shore areas. Ten percent has no preference.

The internal validity and reliability of the estimated WTP models is assessed through multivariate interval regression analysis. Theoretically expected factors are significant and show the expected signs. Controlling for individual beach visitor characteristics, stated WTP not only appears to be significantly determined by beach visitor preferences for the degree of protection of the North Sea and household income, but also visitor interest in visiting the beach like swimming and whether he is a member of or donator to an environmental protection organization. Furthermore, beach visitors are willing to pay significantly more further south along the North Sea coast than up north to the island of Texel.

Finally, the external validity and reliability of the study was tested by investigating respondent perception of the WTP questions. Examining the number of protest bids against

the WTP question as one of the most important indicators of the study's 'external' validity and reliability, this number appears to be very low, adding to the confidence in the validity and reliability of the estimated WTP models. A majority of 80 percent experience no problems answering the WTP questions, 90 percent says that it is clear what exactly they are being asked to pay for, and more than 80 percent feels that the presented information during the interview is sufficient or more than sufficient to answer the WTP questions. Some indication of constructed preferences is found given that almost 40 percent of the respondents claim that the presented information has somewhat influenced their stated WTP. On the other hand, 45 percent claims that the presented information has had no influence on their stated WTP, while only one percent claims that the presented information has had a lot of influence on their WTP reply.

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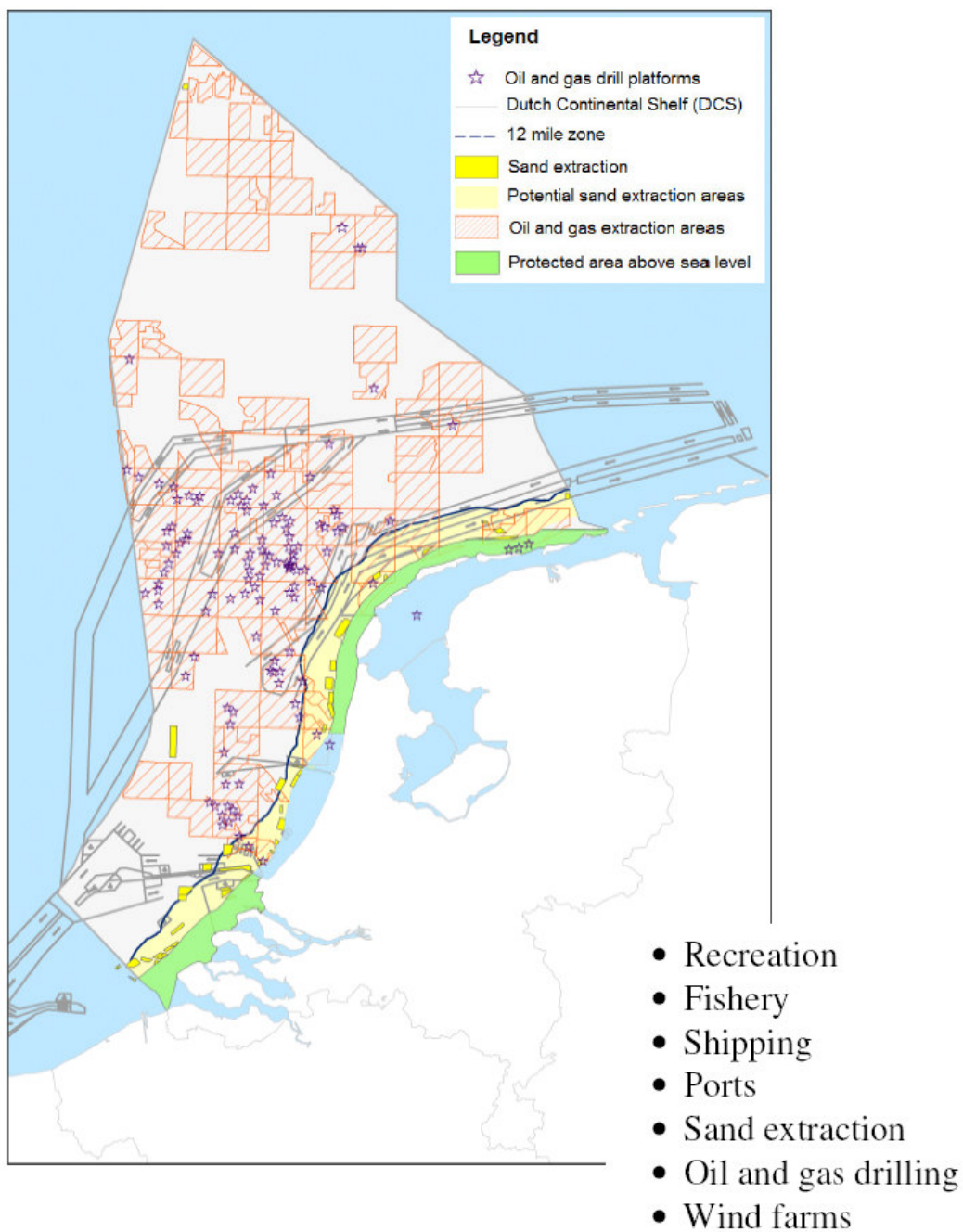
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Annex I: Information cards used in the survey

Card 1: Economic North Sea activities

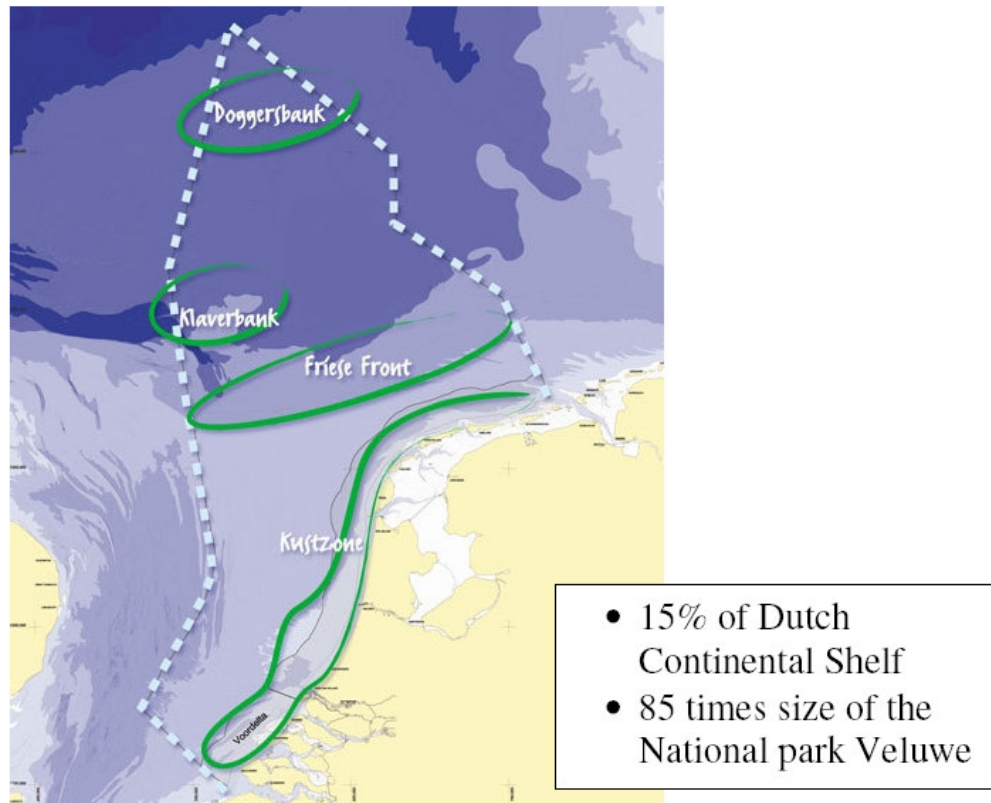


CARD 2: North Sea Threats

- **North Sea largest natural area of the Netherlands**

- **Threats**
 - *Overfishing*
 - *Sea bed disturbance by fishery & sand extraction*
 - *Sea water pollution by*
 - *oil, nitrates, pesticides, litter*
 - *cities, ports, industry, agriculture, shipping, tourism*

Card 3: Dutch Continental Shelf (DCS) natural areas



Harbour porpoise

Pelican's foot

Red gurnard

Gannet

Hermit crab

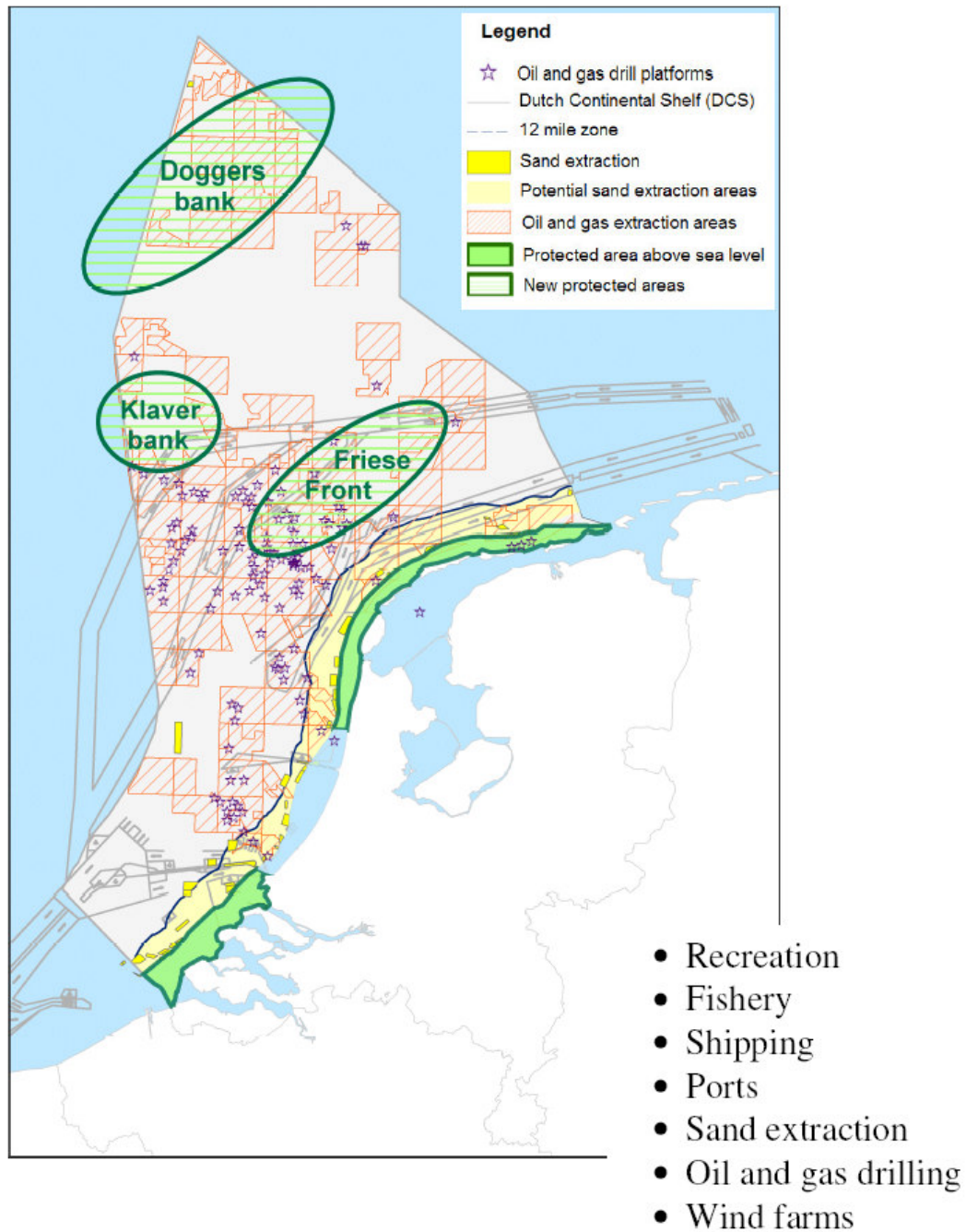
The "**Doggersbank**" is a sand bank in very shallow waters (18 meters below sea level). The water is mostly transparent down to the bottom, allowing even algal growth in the winter. This is a transition area between the Southern and Northern part of the North Sea.

The "**Klaverbank**" is the only area in the Dutch part of the North Sea with a hard substrate. Gravel, sand, rocks and boulders provide a large variation in substrate. This environment provides unique opportunities for the maritime fauna.

At the "**Friese Front**" the shelf sea ends and the deep sea begins. At this border nutrient-rich sediments collect at the bottom. This is a highly productive ecosystem with abundant growth of plankton, benthic fauna and flora, fish, birds and mammals.

Source: Stichting Noordzee

Card 4: North Sea environment-economy conflicts



CARD 5: Future Situations

1) Continuation current situation

- Nothing changes: areas are not protected
- Nature remains under threat
- Pressure on nature increases in next years

2) Protected Areas with limited use

- Areas are protected above and below sealevel
- Limited fishery, shipping, sand extraction and gas drilling under strict control

3) Fully Protected Areas

- Areas are protected above and below sea level
- No fishery, shipping, sand extraction or drilling

CARD 6: Possible measures

- Sustainable management natural areas by imposing constraints on fishery, shipping, sand extraction, gas drilling
- Increasing control on fishery, shipping, drilling
- Environmentally sound fishery practice
- Reduction of sea water pollution by increased and improved treatment of domestic and industrial wastewater
- Double hulled oil tankers
- Warning system oil spill disasters